NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

AN ANALYSIS OF PRIMARY MILITARY OCCUPATIONAL SPECIALITIES ON RETENTION AND PROMOTION OF MID-GRADE OFFICERS IN THE U.S. MARINE CORPS

by

Tracy A. Perry

March 2006

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13. ABSTRACT (maximum 200 words)

The purpose of this thesis is to identify and evaluate factors that affect retention and promotion of mid-grade officers in the U.S. Marine Corps. The analysis includes evaluation of survival patterns to ten-years of commissioned service and promotion patterns to O-4 and O-5. The primary goal is to explain the effect of an officers' primary military occupational specialty (PMOS) on retention and promotion. The Marine Corps Commissioned Officer Accession Career (MCCOAC) data file contains cohort information from FY 1980 through FY 1999 and includes 27,659 observations. Using data from the MCCOAC data file, logistic regression and Cox Proportional Hazard models are used to estimate the effects of an officer's PMOS on survival and promotion patterns of Marine Corps officers.

The findings indicate that an officers PMOS is significantly associated with whether an officer stays until 10 YCS or is promoted to O-4 or O-5. Logistic regression results show that pilot PMOSs are positively correlated with surviving until 10 YCS, but are negatively correlated with promotion to O-4, when compared to Infantry. The results also find that the remaining PMOSs are negatively correlated with whether and officer survives until 10 YCS, when compared to Infantry. In addition, only three PMOSs (0402, 7202, and 7523) are positively correlated with whether an officer is promoted to O-4 or O-5. Finally, the Cox Proportional Hazard results show the effect of having a particular PMOS or occupational field on the hazards of separation and promotion.

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AN ANALYSIS OF PRIMARY MILITARY OCCUPATIONAL SPECIALITIES ON RETENTION AND PROMOTION OF MID-GRADE OFFICERS IN THE U.S. MARINE CORPS

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The Marine Corps Commissioned Officer Accession Career (MCCOAC) data file contains cohort information from FY 1980 through FY 1999 and includes 27,659 observations. Using data from the MCCOAC data file, logistic regression and Cox Proportional Hazard models are used to estimate the effects of an officer's PMOS on survival and promotion patterns of Marine Corps officers.

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I. INTRODUCTION

> If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle.
>
> - Sun Tzu

A. BACKGROUND

In order to maintain a force structure necessary to meet the challenges and demands associated with an evolving mission, the United States Marine Corps annually accesses approximately 1,500 officers through various commissioning sources. The Deputy Commandant for Manpower and Reserve Affairs (DC M&RA) is responsible for building accession and classification plans that meet manpower requirements which shape the force. These force shaping tools are instrumental in providing commanders with the right officer: one with the proper grade and skill set.

The force consists of approximately 19,000 officers. These unrestricted officers are divided into seventeen occupational fields and subdivided into thirty-six primary military occupational specialties (PMOS).[1] "Each PMOS describes the skills, prerequisites, and training for billets requiring the unique capabilities of that PMOS as found on the Table of Organization and Equipment (T/O&E)."[2] Also, the four digit PMOS is an "identifying number used by manpower planners and managers to describe and identify the skills and duties of a particular Marine or group of Marines capable of performing to the standard required by rank of a corresponding billet."[3]

The stability of the officer force relies on accession and classification plans developed by DC M&RA. The accession plan must correctly access new officers

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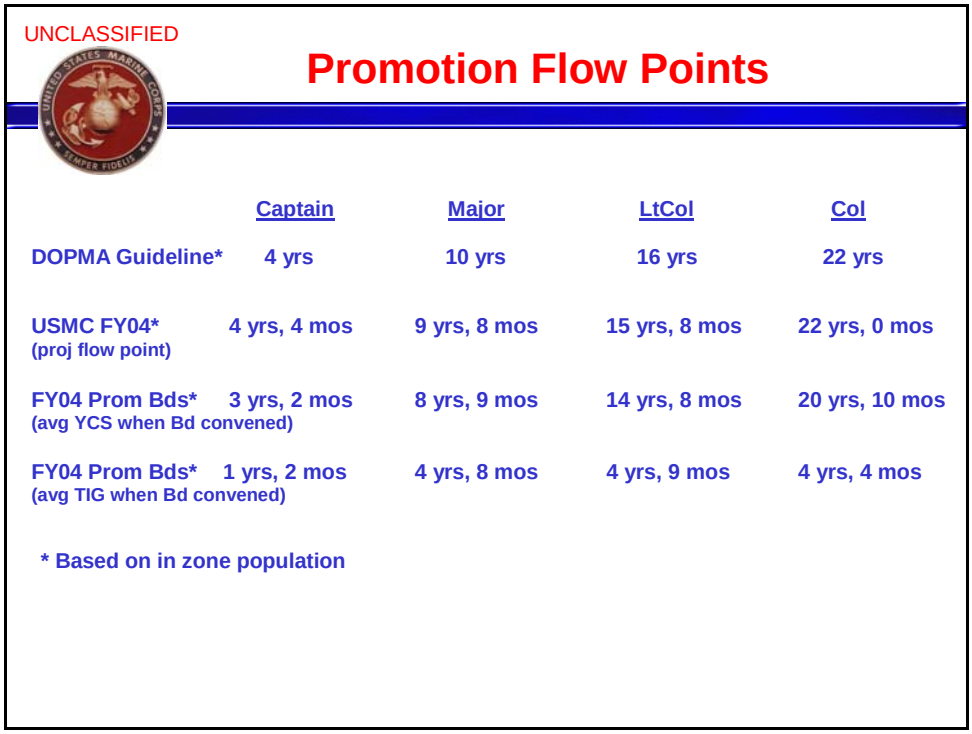
[1] An unrestricted officer is an individual in the Marine Corps in the grade of second lieutenant or above, who is not designated as a limited duty officer (LDO). Marine Corps Promotion Manual, Volume I, Officer Promotions. MCO P1400.31B MMPR-1. 22 February 2000. p. 1-6.

[2] Tables of Organization and Equipment describe the organizational manpower requirements in terms of grade, PMOS, and weapon for military personnel. It is a basic document that describes, in billet line detail, the composition of every Marine Corps organization. Marine Corps MOS System Modification Process. MCO 1200.15B. 31 January 2002. Enclosure (1) p.1.

[3] Ibid.

annually to ensure a sufficient number of second lieutenants will survive to promotion flow points and be eligible for selection to major (O-4) or lieutenant colonel (O-5). Figure 1 provides promotion flow points based on years of commissioned service (YCS) and time-in-grade (TIG) used during fiscal year (FY) 2004 promotion boards.

Figure 1. Promotion Flow Points FY 2004



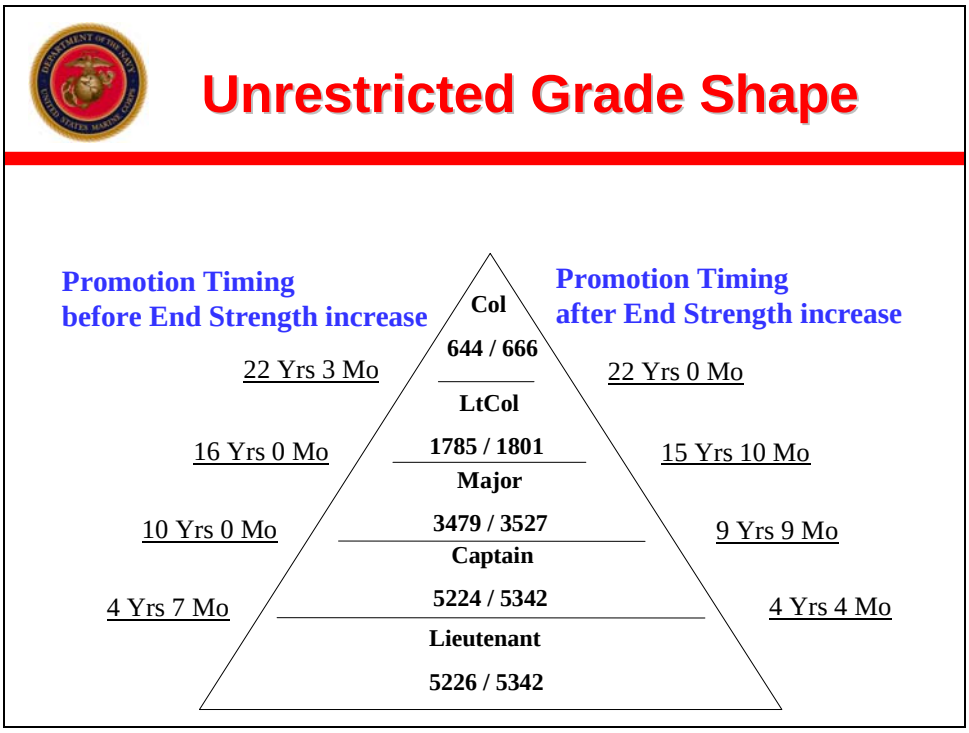
(Source: From HQMC, M&RA, MPP-30, Officer Promotion Planner, 2005)

It is essential to access the correct number of second lieutenants (O-1), but equally important is the expertise attained by these officers through years of training and education within their PMOS. Therefore, proper classification or assignment of PMOSs to junior officers at The Basic School (TBS) is crucial when building inventory needed to fill vacancies at higher ranks in the officer corps pyramid.

To maintain a balance in the pyramidal shape of the officer corps, a complex promotion system must incorporate legal constraints, while meeting end strength goals. Promotion timing is a key component to the unrestricted officer grade shape because it delineates the guidelines used to determine eligible officers, based on time in service as seen in Figure 2. The right side of the pyramid is the promotion timing before the end strength increase in 2005 and the left side of the pyramid shows promotion timing after

the end strength increase. The officer promotion system is bound by the limitations established in the Defense Officer Personnel Management Act (DOPMA) that dictates the number of officers authorized on active duty, above the rank of captain (O-3), recommended promotion opportunities, and promotion timing guidelines as shown in Figure 3.

Figure 2. Unrestricted Grade Shape



(Source: From HQMC, M&RA, MPP-30, Officer Promotion Planner, 2005)

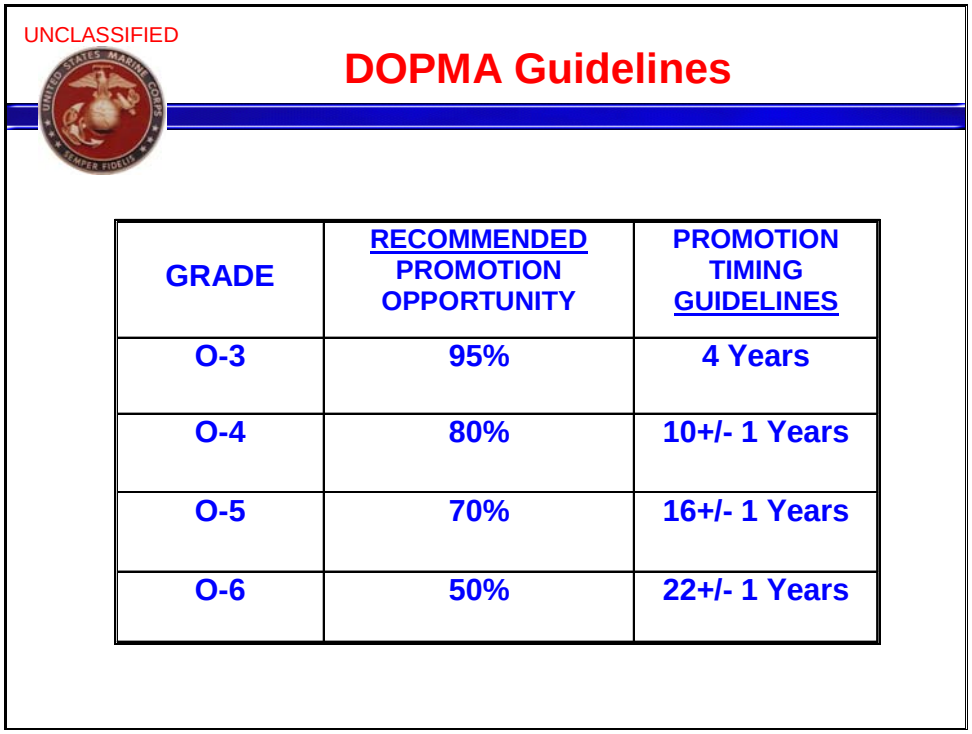
The officer promotion system for the Marine Corps does not promote according to PMOS or occupational field. Instead, the Marine Corps promotes based on the following principle: promote the best and most fully qualified. A promotion is "not considered a reward for past performance, but as incentive to reach the next higher grade."[4]

The objective of the promotion system is to select officers with the "potential to carry out the duties and responsibilities of the next higher grade based upon past

[4] Marine Corps Promotion Manual, Volume I, Officer Promotions. MCO P1400.31B MMPR-1. 22 February 2000. p. 1.

performance as indicated in their official military personnel file."[5] However, the pool of selected officers may not contain the PMOSs necessary to fill billet requirements at the next higher grade, contributing to the imbalances associated with the current promotion system.

Figure 3. DOPMA Guidelines



GRADE	RECOMMENDED PROMOTION OPPORTUNITY	PROMOTION TIMING GUIDELINES
O-3	95%	4 Years
O-4	80%	10+/- 1 Years
O-5	70%	16+/- 1 Years
O-6	50%	22+/- 1 Years

(Source: From HQMC, M&RA, MPP-30, Officer Promotion Planner, 2005)

Manpower Plans and Policy (MPP) annually develops a Five-Year Officer Promotion Plan (FYOPP) that publishes the authorized strength by grade according to Title 10, U.S. Code, Section 523.[6] The plan identifies imbalances in PMOSs and a recommended plan that shows the number of officers in zone for promotion over the next five years.[7] Promotion planners use the FYOPP and the number of vacancies to

[5] Marine Corps Promotion Manual, Volume I, Officer Promotions. MCO P1400.31B MMPR-1. 22 February 2000. p. 1.

[6] U.S. Code, Title 10, Section 523 is the authorized strength for commissioned officers on active duty in grades of major, lieutenant colonel, and colonel.

[7] The Five-Year Officer Promotion Plan serves as a planning tool for the development of each selection board. It contains selection opportunities, zone sizes, numbers authorized to select, and any skill guidance for each grade and competitive category. Also, the plan provides specific guidance on the requirements associated with promotion plans. Marine Corps Promotion Manual, Volume I, Officer Promotions. MCO P1400.31B MMPR-1. 22 February 2000. p. 1-4.

determine the number of promotions by grade needed to achieve the authorized end strength.[8] The plan addresses shortages in specific PMOSs, but promotion boards are not mandated to promote sufficient numbers within critically short PMOSs to meet requirements. Therefore, the current promotion system is inconsistent in meeting the requirements necessary to effectively staff billets by grade and PMOS.

The members of the promotion board receive guidance to address the needs of the Marine Corps in a precept.[9] The precept depicts which PMOSs are critically short, below eight-five percent of the requirement, and board members are directed to "give due consideration to the needs of the Marine Corps for officers with particular skills."[10] Board members are informed that no quota system exists for critically short PMOSs, but an officer's PMOS may be considered when determining who is best and fully qualified to meet the needs of the Marine Corps.

B. PROBLEM

The promotion system above the rank of captain has a critical problem: promotions are not aligned with structure requirements. Instead, promotions are linked directly to the number of vacancies, which over time has created imbalances for certain PMOSs. Certain PMOSs become critically short and the inventory of available officers does not match the grade and PMOS distribution to efficiently staff billets for major and lieutenant colonel. In addition, the problem is compounded due to the inherent nature of the military's structure, where all officers are accessed at the lowest level. Therefore, it takes time to train and educate officers so they are ready to move up the pyramid and assume the duties of mid-grade officers in a particular PMOS.

There are several questions that must be addressed in order to identify what causes PMOSs and occupational fields to fall below eighty-five percent of the requirement. First, does PMOS affect the likelihood that an officer will be selected for

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[8] End strength is the total number of personnel on active duty on 30 September, which must be within plus or minus 1% of authorized end strength. The Manpower Story. p. 2.

[9] A precept is a legal document which orders a selection board to convene. The precept provides instructions governing the proceedings of the board and appoints the president, members, and recorders to the selection board. Marine Corps Promotion Manual, Volume I, Officer Promotions. MCO P1400.31B MMPR-1. 22 February 2000. p. 2-4.

[10] Ibid.

promotion? Second, does PMOS affect the likelihood that an officer will survive until ten years of commissioned service?

C. PURPOSE

The purpose of this research is to explore and identify the importance of Marine Officers' PMOS as it relates to survival and promotion of mid-grade officers in the Marine Corps. The analysis will evaluate promotion to O-4 and O-5. The primary goal of this study is to determine whether PMOS influences promotion when an officer is in zone for O-4 or O-5.[11] A secondary goal of this study is to use survival analysis to determine whether PMOS influences retention rates of Marine Corps officers prior to ten years of commissioned service.

D. RESEARCH QUESTIONS

1. Primary Research Questions

a. Does a Marine officers' primary military occupational specialty (PMOS) have a significant effect on the probability of promotion to O-4 and O-5?

b. Does a Marine officers' primary military occupational specialty (PMOS) have a significant effect on surviving to year ten of commissioned service?

2. Secondary Research Questions

a. Are there significant differences in promotion probabilities between officers in the combat arms occupational field and the other occupational fields?

b. Are there significant differences in survival rates between officers in the combat arms occupational field and the other occupational fields?

c. Does the current promotion system adequately address the mismatch between inventories and requirements?

d. When officers come in zone for promotion, is the board influenced if an officer has a critically short PMOS?

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[11] The promotion zone is defined as a promotion eligibility category consisting of officers from the most senior to the most junior officer eligible for consideration before a selection board in the same grade and competitive category. Marine Corps Promotion Manual, Volume I, Officer Promotions. MCO P1400.31B MMPR-1. 22 February 2000. p. 1-7.

E. SCOPE AND LIMITATIONS

Officers who are in-zone for promotion will be the focal point of the research, followed by those in the above-zone. Promotion precepts will be utilized to analyze critically short PMOSs. Promotion results from 1989 through 2004 will be used to determine if PMOS affects promotion or retention.

The study will include a synopsis of the Marine Corps' manpower and promotion systems. The data sets used in statistical analysis are based on the Marine Corps Commissioned Officer Accession Career (MCCOAC) data file from the Center of Naval Analysis (CNA) and the Marine Officer Cohort data file from the Defense Manpower Data Center (DMDC). The MCCOAC data file combined cohorts of Marine officers' for fiscal years 1980 through 1999. The Marine Officer Cohort data file contains individual cohort data sets of Marine officers for fiscal years 1980 through 2001. The officers' individual record contains data entries covering commissioning to separation or until 31 December 2004 for both data sets.

Cohorts from FY 1980 through 1993 will be analyzed in promotion and retention models to examine the affects of PMOS on selection and survival of majors. Cohorts from FY 1980 through 1988 will be analyzed in promotion and retention models to examine the affects of PMOS on selection and survival of lieutenant colonels. The study will analyze promotion and survival as dependent variables in Logistic Regression and Cox-proportional hazard models.

F. ORGANIZATION OF THE STUDY

The study is organized into six chapters. Chapter II provides an overview of the Marine Corps' manpower and promotion systems. Chapter III reviews past studies and research that have examined promotion and retention. Chapter IV analyzes the MCCOAC and Marine Officer Cohort data files. Also, included in this chapter is a preliminary statistical analysis of the dependent variables. The research methodologies, models, and results are discussed in Chapter V. Chapter VI summarizes the conclusions and recommendations based on statistical analysis.

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II. THE UNITED STATES MARINE CORPS HUMAN RESOURCE DEVELOPMENT PROCESS AND PROMOTION SYSTEM

> Strategy without tactics is the slowest route to victory. Tactics without strategy is the noise before defeat.
>
> - Sun Tzu

A. THE MARINE CORPS HUMAN RESOURCE DEVELOPMENT PROCESS

In order to understand the Marine Corps promotion process fully, it is necessary to be familiar with the Human Resource Development Process (HRDP) which includes manning and staffing of Marine Corps personnel.[12] The four major commands responsible for the HRDP include: Marine Corps Combat Development Command (MCCDC), Manpower and Reserve Affairs (M&RA), Marine Corps Recruiting Command (MCRC), and Training and Education Command (TECOM).

The HRDP has two fundamental constraints: budgetary limitations and current inventory. First, the Marine Corps cannot afford to purchase all the manpower requirements listed on the T/O&E because personnel costs must be balanced with efforts to modernize aging equipment. Second, the current assignable inventory does not match the grade and PMOS requirements listed on the authorized strength report.

The HRDP intricately combines the capabilities of four interdependent commands to provide the appropriate number of trained and experienced Marines to units throughout the Corps in order to fulfill their mission. Although, the commands have separate mission statements, their roles in the HRDP are vitally linked as seen in Figure 4.

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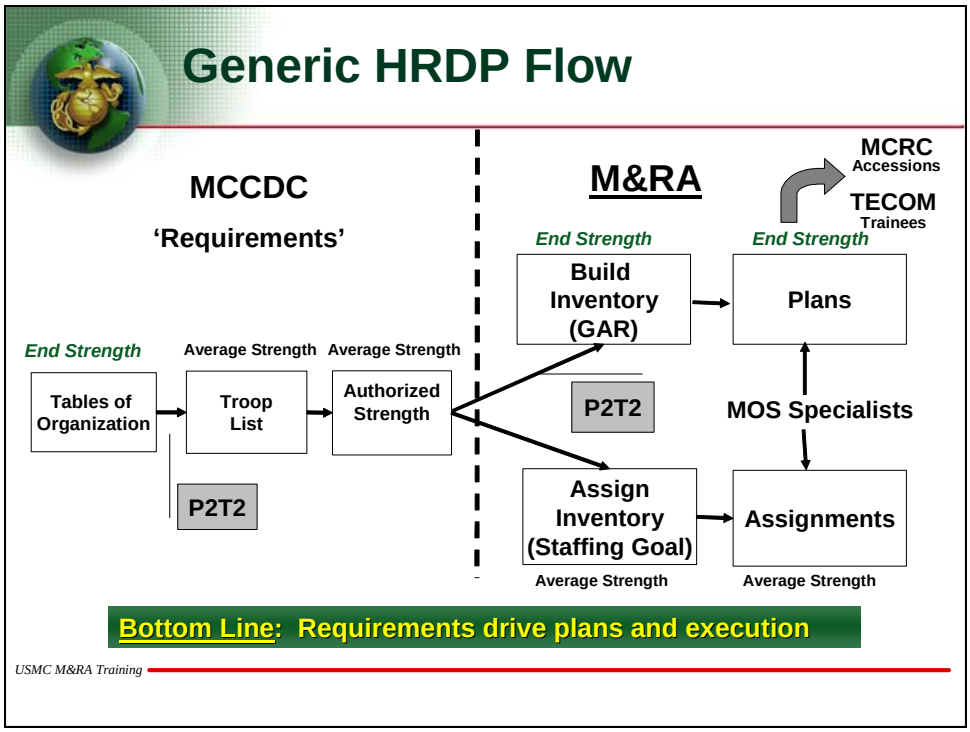
[12] The Human Resource Development Process is the overall process of building and maintaining a sufficient inventory of Marines to meet Marine Corps organizational requirements. The allocation of manpower resources is known as "manning." Manning is defined as the portion of a unit's T/O&E that, within budgetary constraints, is authorized to be filled with Marines. The assignment of individuals to organizations is known as "staffing." Staffing is defined as the portion of manning that can be filled with assignable inventory. Marine Corps Order 5320.12E, Precedence Levels for Manning and Staffing, 28 August 2003, p.2.

Figure 4. The Marine Corps' Human Resource Development Process



(Source: From HQMC, M&RA, Manpower 101, Major Zimmerman, 2005)

1. The Role of Marine Corps Combat Development Command

The HRDP and the manning process begins with the Marine Corps Combat Development Command.[13] The Deputy Commandant in charge of MCCDC is responsible for developing war fighting capabilities for present and future operations. The mission of MCCDC is to "develop Marine Corps war fighting concepts and determine associated required capabilities in the areas of doctrine, organization, training and education, equipment, and support and facilities to enable the Marine Corps to field combat-ready forces; and participate in and support other major processes of the Combat Development System."[14]

The Marine Corps Combat Development Command is responsible for allocating and distributing limited manpower resources according to established precedence levels

[13] The manning process determines which structure spaces the Marine Corps intends to man. The manning process has three principle inputs: T/O&Es, end strength, and prisoners, patients, trainees and transients (P2T2). The manning process has two principle outputs: the troop list and the authorized strength report. Manning is about billets, not people.

[14] Marine Corps Combat Development Command website, http://www.mccdc.usmc.mil, (Accessed on 28 November 2005.

for manning and staffing. The three precedence levels include: excepted commands, priority commands, and proportionate share (pro share) commands. Excepted commands are manned and staffed at 100 percent of chargeable T/O&E by grade and PMOS.[15] Priority commands are manned and staffed at 95 percent of chargeable T/O&E by grade and PMOS, if current inventory permits.[16] The pro share commands will receive fair share apportioned manning and staffing at approximately 90 percent of chargeable T/O&E.[17] Excepted and priority commands affect manning requirements and ultimately the distribution by grade and PMOS of officer billets that the Marine Corps decides to man.

The Total Force Structure Division (TFSD), a branch of MCCDC, is responsible for integrating and allocating manpower and equipment requirements to enhance the fundamentals of Expeditionary Maneuver Warfare and to fulfill the Marine Corps' Title 10 responsibilities.[18] In addition, TFSD provides a single framework for integrated manpower decisions necessary to achieve the Corps' maneuver warfare mission based on authorized end strength.[19] Total Force Structure Division maintains the Table of Manpower Requirements (TM/R), which compiles all the tables of organization and equipment into a database to provide a single source for manpower and equipment requirements for each organization in the Marine Corps. Also, TFSD is responsible for maintaining, managing and publishing T/O&Es through the application of Total Force Structure Management System (TFSMS).[20]

The Tables of Organization and Equipment are the building blocks needed to allocate available manning and equipment to separate organizations utilizing the Troop List (T/L) and the Authorized Strength Reports (ASR). The Troop List "determines the number of officers and enlisted Marines a unit is allocated each year of the Program

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[15] Marine Corps Order 5320.12E, Precedence Levels for Manning and Staffing, 28 August 2003, p.2.

[16] Ibid.

[17] Ibid.

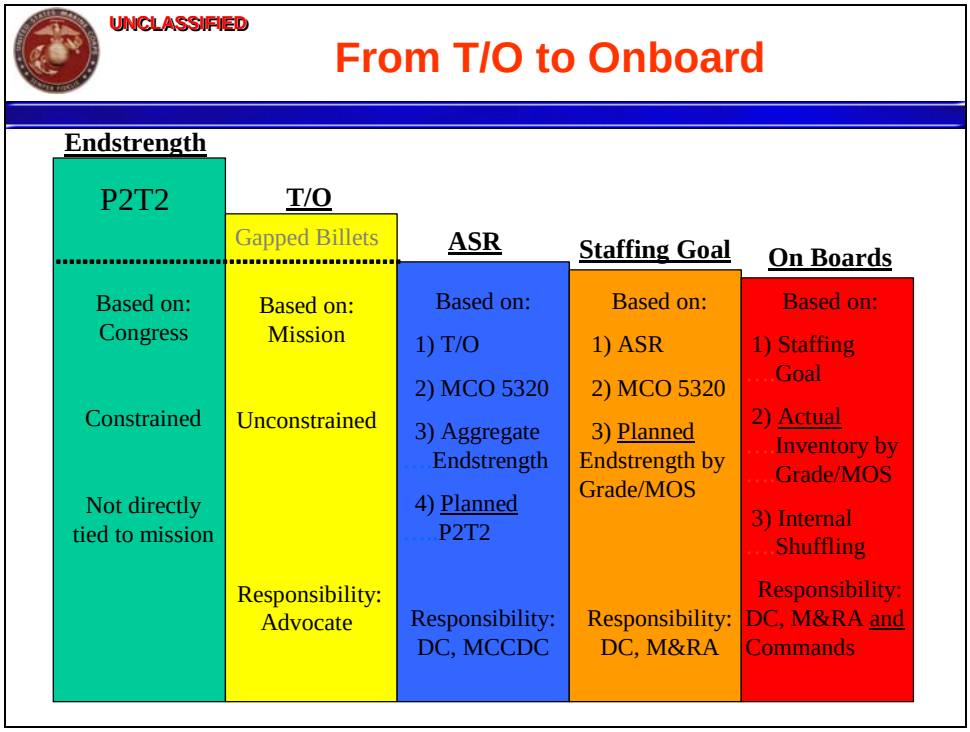
[18] The Total Force Structure Division website, https://tfsms-app1.mccdc.usmc.mil, (Accessed on 28 November 2005).

[19] Ibid.

[20] The Total Force Structure Division website, https://tfsms-app1.mccdc.usmc.mil, (Accessed on 28 November 2005).

Objective Memorandum (POM) planning horizon."[21] The Troop List does not list the Marine's grade or PMOS; it merely provides a gross number of officers and enlisted personnel. In addition, the Troop List does not match the manpower requirements on the T/O&E because of budgetary constraints defined in the POM. The Marine Corps cannot fund 100% of the required billets listed on the T/O&E and therefore some billets are gapped as seen in Figure 5.

Figure 5. From Table of Organization to Onboard

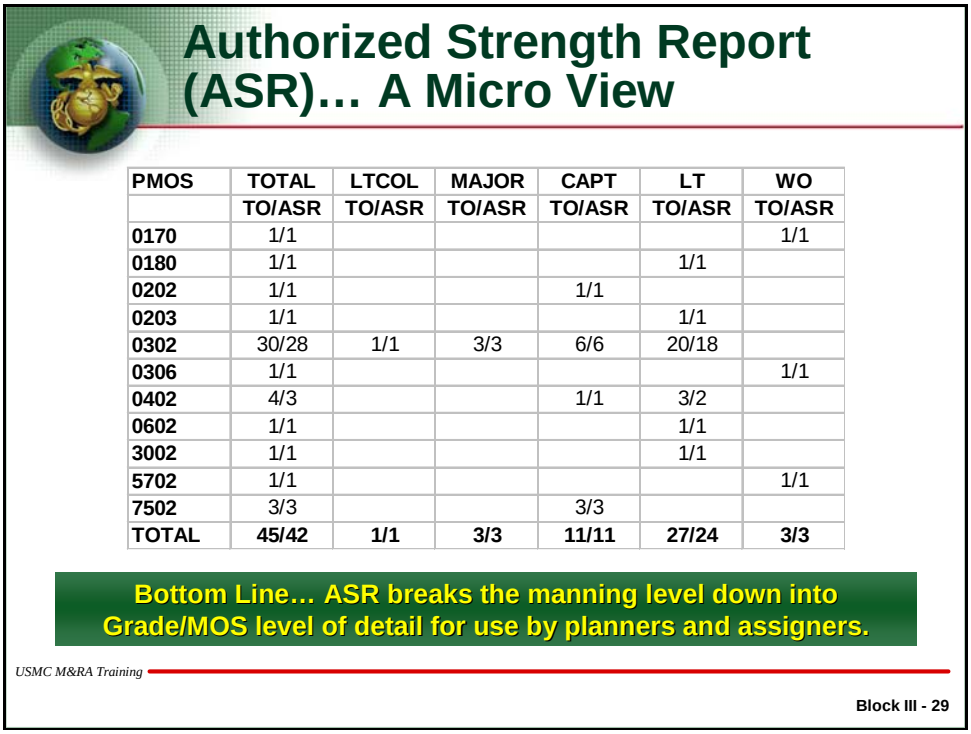


(Source: From HQMC, M&RA, MMOA-5, LtCol Strobl, 2005)

The ASR converts the macro level manning numbers of the T/L into micro level manning numbers, as seen in Figure 6. Specifically, the ASR allocates manning requirements to units by grade and PMOS. The difference between the T/O&E and the ASR are gapped billets. As shown in Figure 6, the T/O&E requirement for the number of lieutenants in an infantry battalion is 27, but the ASR only allocates 24 billets therefore 3 billets are gapped. The ASR is the linking document between MCCDC and M&RA.

[21] The Program Objective Memorandum is how the Marine Corps prioritizes needs and allocates resources. The POM encompasses an 8 year planning horizon, where end strength is fixed, in order to inject fiscal reality into the manpower process. The Manpower Story. p. 1.

Figure 6. Example of an Authorized Strength Report



Authorized Strength Report (ASR)… A Micro View

PMOS	TOTAL	LTCOL	MAJOR	CAPT	LT	WO
	TO/ASR	TO/ASR	TO/ASR	TO/ASR	TO/ASR	TO/ASR
0170	1/1					1/1
0180	1/1				1/1	
0202	1/1			1/1		
0203	1/1				1/1	
0302	30/28	1/1	3/3	6/6	20/18	
0306	1/1					1/1
0402	4/3			1/1	3/2	
0602	1/1				1/1	
3002	1/1				1/1	
5702	1/1					1/1
7502	3/3			3/3		
TOTAL	45/42	1/1	3/3	11/11	27/24	3/3

Bottom Line… ASR breaks the manning level down into Grade/MOS level of detail for use by planners and assigners.

USMC M&RA Training

Block III - 29

(Source: From HQMC, M&RA, Manpower 101, Part IV, 2005)

2. The Role of Manpower and Reserve Affairs (M&RA)

The Deputy Commandant in charge of M&RA is responsible for providing "commanders with the right Marines, in a timely manner, utilizing a disciplined process that incorporates effective quality of life programs and services for all who serve and also provide commanders meaningful manpower policies."[22] Manpower and Reserve Affairs is structured with six divisions, but only two divisions receive the ASR. Manpower Management Division (MM) utilizes the ASR to begin the staffing process or distribution of current inventory. Manpower Plans and Policy Division (MP) utilizes the ASR to develop manpower plans in order to build future inventory of Marines.

Manpower Management Division is "responsible for the administration, retention, distribution, appointment, evaluation, awarding, promotion, retirement, discharge, separation, and service records of commissioned officers, warrant officers, and enlisted

[22] Manpower and Reserve Affairs website, https://manpower.usmc.mil, (Accessed on 2 December 2005).

personnel of the Marine Corps and Marine Corps Reserve."[23] The Officer Assignment Branch (MMOA) within MM Division is responsible "matching the current assignable inventory to the manning levels identified in the ASR."[24] Prior to assigning officers, MMOA runs an officer staffing goal model. This model combines billets identified by MCCDC to be manned with available officer inventory in order to optimize the staffing process. The output of the officer staffing goal model provides, in theory, the best match between billet requirements and assignable inventory based on precedence levels and the needs of the Marine Corps. The difficulty in the staffing process is that assignable inventory never matches the requirements. Therefore, monitors must decide which billets are staffed and which are gapped.[25]

The plans created by MP Division must meet the following objectives: "maintain end strength, shape end strength to meet requirements, promote at established points, maintain grade percentages according to DOPMA, and provide a definable career path."[26] The MP Division needs to build enough Marine officers by grade and PMOS to minimize the difference between future requirements and inventories.

The planners at MP Division utilize authorized end strength numbers, the number of Marines who are classified as a prisoner, patient, trainee, or transient (P2T2), and the ASR as inputs for the grade adjusted recapitulation (GAR) report.[27] The GAR recognizes PMOSs listed on the ASR and allocates B-billets in the ASR back to PMOSs.[28] In addition, the GAR accounts for P2T2 in every PMOS. The GAR must account for historical attrition rates, promotion rates, and retention rates by PMOS in order to grow a cohort to meet future inventory levels. The GAR produces the ideal inventory to meet future requirements to fill all ASR billets. Planners use the GAR numbers as guidelines when they write their plans. The GAR is used in the Marine Corps

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[23] Manpower and Reserve Affairs website, https://manpower.usmc.mil, (Accessed on 2 December 2005).

[24] The Manpower Story. p.4.

[25] A monitor is responsible for staffing billets according to PMOSs.

[26] HQMC, M&RA, Manpower 101, Part IV.

[27] The Manpower Story. p.5.

[28] B-billet can be either PMOS specific, PMOS non-specific (not special assignment) and PMOS (special assignment: recruiting, drill field, and Marine Security Guard duties).

officer promotion process to determine PMOS mismatches between current inventory and requirements. Therefore, when addressing requirements the officer promotion process does not utilize the T/O&E or the ASR, instead the GAR report is used.

The plans written annually by MP Division include: accession plans, classification plans, promotion plans, and retention plans. The promotion and retention plans are delivered to MM Division. The classification plan is delivered to MM Division and TECOM. The accession plan is delivered to Marine Corps Recruiting Command and TECOM.

3. The Role of Marine Corps Recruiting Command

The officer accession plan is incorporated into MCRC's annual mission of officer procurement. Marine Corps Recruiting Command is responsible for procuring "qualified individuals, in sufficient numbers to meet the established personnel strength levels, officer and enlisted, of the Marine Corps and Marine Corps Reserve."[29]

4. The Role of Training and Education Command

Training and Education Command utilizes the classification plan to ensure adequate training slots are available to officers' assigned PMOSs at TBS and to develop training pipelines. In addition, the officer accession plan is used to forecast the influx of officers arriving at training commands. The mission of the TECOM is to "develop, coordinate, resource, execute, and evaluate training and education concepts, policies, plans, and programs to ensure Marines are prepared to meet the challenges of present and future operational environments."[30]

B. MARINE CORPS OFFICER PROMOTION SYSTEM

Promotions are the building blocks of the Marine Corps, "they provide, from within, the critical expertise and leadership so vital to our combat readiness."[31] The Marine Corps officer promotion system is vacancy driven based on requirements established by the ASR, re-calculated by the GAR, and further constrained by DOPMA grade tables.[32] The grade tables specifically outline the number of field grade officers

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[29] HQMC, M&RA, Manpower 101, Part IV.

[30] Ibid.

[31] White Letter No. 05-97, Commandant of the Marine Corps, 9 June 1997.

[32] HQMC, M&RA, MPP-30, Officer Promotion Planner, Flow Points.

authorized based on end strength, an example is shown in Table 1. The goal of the officer promotion process is to maintain grade inventory based on grade table authorization.[33] The grade tables are designed to support the promotion flow points, illustrated in Figure 1, and promotion opportunity guidelines illustrated in Figures 7 & 8.

Table 1. DOPMA Grade Table, Officer Strength and Distribution in Grade

Marine Corps Officers	**Major**	**Lieutenant Colonel**	**Colonel**
10,000	2,525	1,480	571
12,500	2,900	1,600	592
15,000	3,275	1,720	613
17,500	3,650	1,840	633
20,000	4,025	1,960	654
22,500	4,400	2,080	675
25,000	4,775	2,200	695

(Source: Title 10, Armed Forces, Section 523, 7 January 2003)

Promotion opportunity is a percentage of the number of officers authorized to be selected and the number of officers in zone for promotion. Promotion opportunity comparisons between DOPMA and the Marine Corps for major and lieutenant are shown in Figures 7 and 8. The DOPMA guidelines have an authorized variance of plus or minus ten percent. The promotion opportunities for both major and lieutenant colonel are currently within DOPMA guidelines. Over the last eight years the Marine Corps has met or exceeded these guidelines. The "overarching factor in the officer promotion process is that it is based on law, not policy."[34] These regulations provide the basis for officer promotions and impose strict and specific requirements on how promotion boards are conducted: Title 10, United States Code Armed Forces, Chapter 36 – Promotion, Separation and Involuntary Retirement of Officers on the Active Duty List, and Chapter

[33] HQMC, M&RA, MPP-30, Officer Promotion Planner, Flow Points.

[34] Manpower and Reserve Affairs website, https://manpower.usmc.mil (Accessed on 2 December 2005).

1400 – Promotion, Retention of Officers on the Reserve Active-Status List, and several Secretary of the Navy (SECNAV) Instructions.

The officer promotion process has five main areas: basis for officer promotions, pre-board process, during board process, post-board process, and the officers' role in the promotion process. The basis for officer promotions outlines the legal background and references, listed above, which govern the promotion process. The pre-board and during board processes are covered in greater detail below. The post-board process outlines the actions that occur after the board has selected the best and fully qualified officers. The officers' role in the promotion process provides information on the responsibilities of those officers who are in zone for promotion.

1. Definitions

The following definitions describe common terms utilized when discussing the officer promotion system for the Marine Corps.[35]

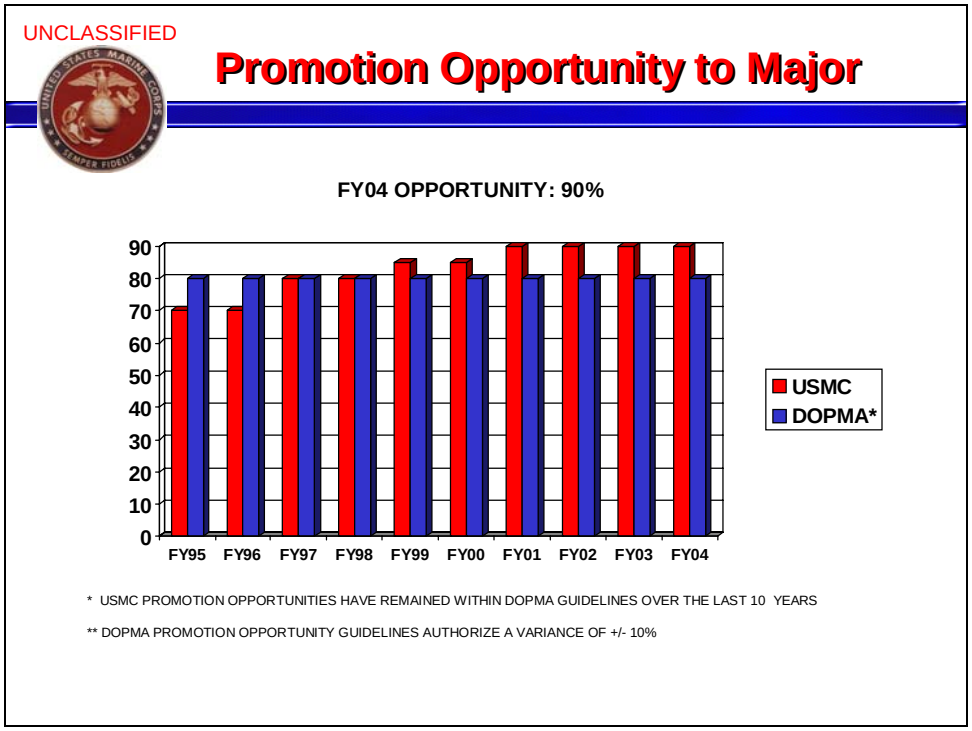
- Above-zone (Above the Promotion Zone): Above-zone officers have been previously considered in the in-zone population, and not selected for promotion by a regularly scheduled board. These officers will incur an additional failure(s) of selection if not selected by the selection board.
- In-zone (Promotion Zone): In-zone officers have neither failed of selection for promotion nor have been removed from the promotion list. In-zone officers consist of primarily eligible population for consideration by the selection board, and if not selected, the officer will incur a failure to selection. It is common to have officers whose lineal precedence falls within the above-zone population, but are in-zone officers. These officers will be given the same consideration as any other in-zone case. This zone is used to generate the authorized number of officers to select and the selection opportunity.
- Below-zone (Below the Promotion Zone): Below zone officers are junior to officers in the promotion zone. Below-zone officers are eligible for consideration, but if not selected, they will not incur a failure of selection. Not all boards are authorized to consider below-zone officers. Additionally, the below-zone population is a rough estimate of the following year's in-zone population.
- Grade: Grade is a progressive scale of office or military rank that is established and designated as a grade by laws or regulations. It denotes a

[35] Marine Corps Promotion Manual, Volume I, Officer Promotions. MCO P1400.31B MMPR-1. 22 February 2000. p. 1-7.

grade to which a permanent or temporary appointment has been tendered by component authority and accepted by a member of the Armed Forces.

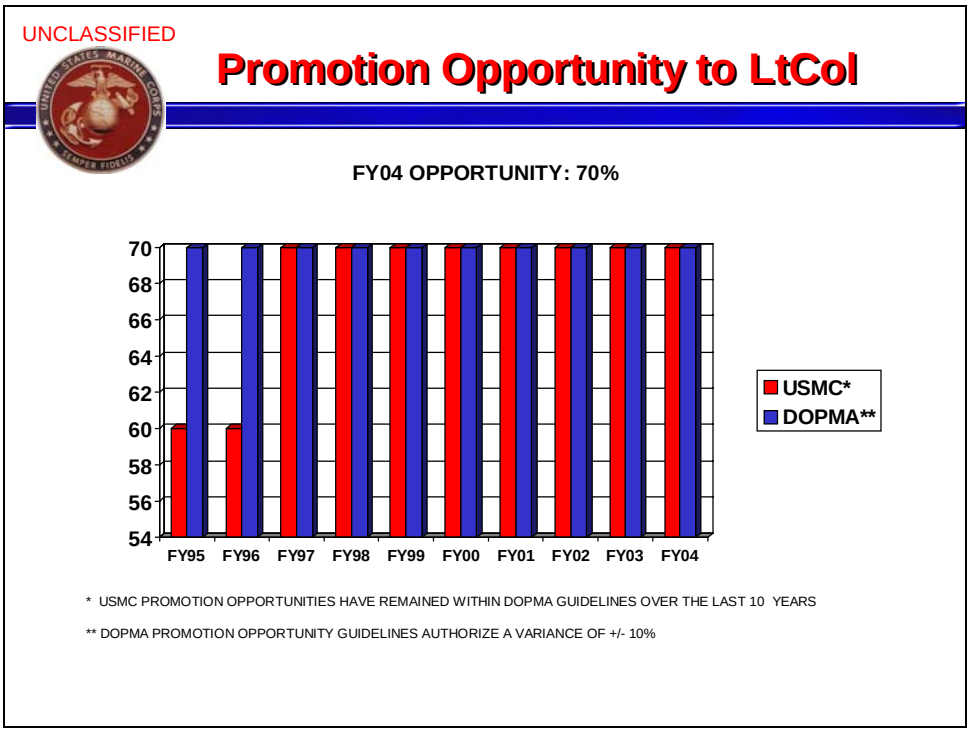
- Rank: Rank means the order of precedence among members of the Armed Forces. Officers of the same grade take precedence amongst themselves according to their respective date of rank.
- Competitive Categories: A category established to provide for separate promotion consideration and career development of groups of officers possessing related skills and experience necessary to meet the mission objectives of the Department of the Navy. The Commandant of the Marine Corps has divided the officer corps into five major categories: unrestricted, restricted (Limited Duty Officers), Warrant and Chief Warrant Officers (WO/CWO), and Specialist Officers. Within these divisions, officers are considered among their own competitive category on either the active-duty list or Reserve active-status list.
- Unrestricted officers: An unrestricted officer is an individual in the Marine Corps in the grade of second lieutenant or above, who is not designated as a Limited Duty Officer. All unrestricted officers compete among other unrestricted officers of the same grade for promotion to captain through major general via selection boards.

Figure 7. Promotion Opportunity to Major



(Source: From HQMC, M&RA, MPP-30, Officer Promotion Planner, 2005)

Figure 8. Promotion Opportunity to Lieutenant Colonel



(Source: From HQMC, M&RA, MPP-30, Officer Promotion Planner, 2005)

2. Pre-board Process

The pre-board process has four parts: the promotion plan, the precept, the convening message, and communication to the board. The five year officer promotion plan, updated annually, "serves as a planning tool for the development of each selection board."[36] An example of the promotion plan is shown in Table 2 and there are several factors that affect the promotion plan:[37]

- The number of positions needed to meet the needs of the Marine Corps.
- The estimated number of officers needed to fill vacancies during the period in which it is anticipated that the officers selected for promotion will be promoted and the number of officers authorized by the Secretary of the Navy to serve in the grade and competitive category under consideration.
- Based on such determination the Secretary of the Navy shall determine the authorized number to be selected among officers which the selection board may recommend for promotion.

[36] Manpower and Reserve Affairs website, https://manpower.usmc.mil, (Accessed on 2 December 2005).

[37] Ibid.

- The impact of zone size and selection opportunity on time in service promotion flow points to the next higher grade.

Table 2. FY07 Colonel Through Captain Promotion Plan

Grade	Auth	Recommended	Unrestricted	Restricted
General	80	80	80	0
Colonel	668	668	668	0
Lieutenant Colonel	1,811	1,811	1,760	51
Major	3,558	3,558	3,398	160
Captain	N/A	5,426	5,196	230
Lieutenant	N/A	5,425	5,425	0
Warrant Officer	N/A	1,950	0	1,950

(Source: Memorandum for Under Secretary of the Navy, MPP-31, 2005)

The precept is the legal document from the Secretary of the Navy which orders an officer selection board to convene. In addition, the precept lists critically short PMOSs in order to alert members of the board to give those officers special consideration as seen in Table 3. The convening message provides written notice to eligible officers and contains: the convening date of the board, name and date of rank for the senior and junior officer in zone for promotion, and other administrative information. An officer is allowed to provide written communication to the board to clarify or update information.

Table 3. Critically Short PMOSs for FY06 Major Selection Board, USMC

PMOS	Skill	Number Short	Percentage Short of Requirement
0180	Adjutant	40	43%
02XX	Intelligence	81	35%
0602	Command and Control	42	18%
6602	Aviation Supply	12	23%
72XX	Air Command & Control	40	30%

(Source: M&RA, Promotion Branch, FY06 USMC Major Precept, 2005)

3. During Board Process

Officers assigned to the promotion board receive a random set of case files, which include officers in the above-zone, in-zone, or below-zone. A significant amount of time is allocated to thoroughly review each officer's case file in order to provide the promotion board with the knowledge needed to make an informed decision. The case files contain: "individual's promotion photograph, the Marine's official military

personnel file (OMPF), and his/her master brief sheet (MBS) – a chronological overview of one's fitness reports from The Basic School to his/her present assignment."[38] It may take up to an hour per case file to prepare a brief that is presented during an Executive session. "Executive session is the term used upon commencement of briefing or voting cases."[39]

There is a period of time during the board process in which members of the board decide whether case files from the above-zone and below-zone are deemed worthy of being briefed with the in-zone case files. This is called the In\Out briefing and voting secession and, if the case file is selected, then it is referred to as a "premier case."[40]

After the In and Out briefing, board members finalize their briefs for the Full Briefing and Voting secession and the Final Executive secession. A brief typically lasts between eight and ten minutes, and the board member assigned the case file provides the "descriptive information gleaned from the record, and then recommends to the board a numerical representation on the individuals promotion standing among all the cases he/she is briefing."[41] The following is a typical brief: MBS correct, awards received, fitness report comparisons, reporting senior and reviewing officers' rankings, whether or not the officer is a critically short PMOS, photograph if available, height and weight, letters of recommendations, educational level, physical fitness score, TBS class standing, professional military education, basic military training requirements, and any amplifying information on a fitness report.[42]

After all case files are briefed; the voting process begins "on each individual case predicated upon the guidance contained in the precept and the strength of the individual's record of service as briefed to the board."[43] The board members are instructed to adhere to their oath and voting "yes" indicates they believe that the "officer's qualification and

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[38] How a Promotion Board Works, Circa 1998. Colonel William J. Wesley. p.15.

[39] Manpower and Reserve Affairs website, https://manpower.usmc.mil, (Accessed on 2 December 2005).

[40] Ibid.

[41] How a Promotion Board Works, Circa 1998. Colonel William J. Wesley. p.16.

[42] Ibid.

[43] Ibid.

performance of duty clearly demonstrates that the officer would be capable of performing the duties of the next higher grade."[44] In addition, the officers selected are the best and most fully qualified of those eligible for promotion. Board members have a limited amount of "yes" votes, based on the promotion plan and determined by the board president. There are several iterations of voting until the number selected matches the allocation authorized by the SECNAV.

[44] Manpower and Reserve Affairs website, https://manpower.usmc.mil, (Accessed on 2 December 2005).

III. LITERATURE REVIEW

> A military operation involves deception. Even though you are competent, appear to be incompetent. Though effective, appear to be ineffective.
>
> - Sun Tzu

A. OVERVIEW

The literature emphasizing retention and promotion of mid-grade officers in the Marine Corps has grown steadily over the last several years. However, limited research has examined the effect of an officer's PMOS on retention and promotion. Prior studies have focused on identifying and analyzing (significant) variables, other than PMOS, that affect retention or promotion by focusing on the number of months until promotion or separation. Other studies have focused on identifying and analyzing variables, other than PMOS, at a particular juncture at which critical decisions are made. Some studies combine occupational fields in order to analyze the effects on the dependent variable.

The literature describes a wide array of methodologies used to identify variables that help to explain retention or promotion patterns. Some of these studies have a significant role in the development of the models used in this thesis. The information presented in this chapter is an overview of the approaches, methodologies, and findings in the literature.

B. PROMOTION

1. Study by Long (1992)

Long (1992) examined promotion rates of mid-grade officers in the Marine Corps, focusing on variables that are independent of performance. The models developed in his thesis provide promotion predictors intended to assist officers in career assignment decisions. The Management Information Branch at Headquarters Marine Corps (HQMC) provided the longitudinal data covering FY 1986 through FY 1992 used by Long to conduct categorical data analysis on the officer cohorts.

Long grouped PMOSs into the following categories: combat arms, fixed wing pilot, rotary wing pilot, naval flight officer (NFO), and support. Long found that some PMOSs were selected for promotion at an above average rate one year and below average rate in other years. The fitted odds allow a direct comparison between two officer's

chances of selection for promotion, based on certain variables included or excluded from the promotion models. The difference between the models' prediction and the actual promotion data varied from 1% to 14%. The findings from the initial promotion model indicate that some occupational fields have significantly different promotion rates. Long showed that billet and duty assignments are contributing factors that affect promotion rates.

2. Study by Hamm (1993)

Hamm (1993) analyzed variables associated with success or failure of officers in zone for promotion to O-4 in order to profile the successful Marine officer. His data set included 17,870 officers who attended TBS during the time period of 1980 through 1991. In addition, Hamm intended to determine if race contributes to differences in performance, promotion, and retention.

Hamm's findings show that selection rates to O-4 did not differ significantly by race. In addition, there was no significant difference associated with selection rates between officers in different occupational fields. The results show that commissioning source, GCT scores higher than 120, and class standing at TBS were significant variables in determining selection rates.

3. Study by Grillo (1996)

Grillo (1996) uses data provided by the Manpower Analysis Section at HQMC to identify factors related to selection to major in the Marine Corps. He analyzed all captains in zone for promotion during fiscal years 1994 and 1995, focusing on the differences in promotion rates among racial/ethnic groups and gender differences. In addition, he examined the differences between promotion rates of officers in critically short PMOSs versus officers in PMOSs that were above 85% of the requirements listed on the GAR. Grillo analyzed critically short PMOSs and if an officer possessed a critically short PMOS then he examined that individual's probability of selection.

Grillo estimated the independent effects of PMOSs listed on the precept using multivariate regression models. The estimates showed that if an officer had a PMOS listed as critically short then he or she was selected at a rate of 58.5%. If an officer did not have a PMOS listed as critically short then he or she was were selected at a rate of 62.5%. Having a critically short PMOS listed on the O-4 selection board precept was not

statistically significant during FY 1994 or FY 1995. However, Grillo did conclude that promotion selection is based on performance indicators.

4. Study by Wielsma (1996)

Wielsma (1996) used a cohort data file from the Defense Manpower Data Center (DMDC) to analyze factors associated with promotion to O-4, retention to O-4 promotion point and actual performance ratings. He analyzed all officers commissioned into the Marine Corps during FY 1980. The individual records and all variables were updated annually through 1994. Although Wielsma focused on the effects of graduate education on promotion to O-4, he analyzed occupational communities by categorizing PMOSs into one of five categories, as seen in Table 4.

Wielsma, using a simple probit promotion model and interpreting the probit estimates, found that obtaining a post-graduate degree had a significant positive effect on selection to O-4. In addition, he discovered that TBS class standing had a significant effect on selection to O-4. The five occupational categories included in the model were not statistically significant and did not affect the promotion outcome.

Table 4. Occupational Variable by Occupational Field and Description

Variable	OCCFLD	Description
Combat	03XX	Infantry
	08XX	Field Artillery
	18XX	Tank and Assault Amphibian
Service	01XX	Personnel and Administration
	34XX	Audit, Finance, and Accounting
	40XX	Data Systems
	41XX	Marine Corps Exchange
	43XX	Public Affairs
	44XX	Legal Service
	46XX	Training and Visual Information Support
Support	02XX	Intelligence

Variable	OCCFLD	Description
	04XX	Logistics
	13XX	Engineer
	25XX	Communications
	26XX	Signals Intelligence
	30XX	Supply Administration and Operations
	35XX	Motor Transport
Aviation Support	59XX	Electronics Maintenance
	60XX	Aircraft Maintenance
	72XX	Anti-Air Warfare
Pilots	75XX	All pilots and Naval Flight Officers

(Source: From Wielsma, 1996)

5. Study by Quester and Hiatt (2001)

Quester and Hiatt (2001) from the Center of Naval Analysis completed a report titled "Street-to-Fleet for Commissioned Officers" in February of 2001. The study accumulated data from commissioning to separation on Marine Corps officer cohorts from FY 1980 through FY 1999 in order to evaluate retention and promotion patterns. They developed the Marine Corps Commissioned Officer Accession Career (MCCOAC) SAS data file, which begins by combining initial accession information with TBS performance data for officers accessed between 1980 and 1999. The MCCOAC is updated annually by the Headquarters Master File (HMF) and separation data obtained through the Accession Retention Statistic Tracking (ARSTAT) file. The ARSTAT file maintains a record on each separation from the Marine Corps dating back to 1979.

The MCCOAC file is used to describe the street-to-fleet process by annotating information from TBS, first HMF record, augmentation, PMOS and full duty attainment, promotion(s), and separation. A key variable in the MCCOAC file is TBS_TH which identifies the third of the TBS class in which an officer graduated. (This variable has been used in several studies and is significant in predicting promotion and retention patterns.) This study shows that 82.5% of officers who graduated in the top third at TBS

continue service beyond five years of active duty, compared to 67.6% of officers who graduated in the bottom third.

Quester and Hiatt analyzed promotion probabilities to major in the Marine Corps from 1980 through 1990. The study showed that the "street-to-major" probability across all fiscal years studied was 32.7%. Several trends developed over the period studied: promotion time to major fell from 148.8 months to 117.0 months and the probability of being selected for major in a particular fiscal year group has steadily increased from approximately 30% to just over 40%. In addition, an officer who graduated in the top third of his/her TBS class has a 43.6% probability of being selected compared to a 22.1% probability for an officer in the bottom third.

6. Study by Vasquez and Williams (2001)

Vasquez and Williams (2001) studied the implications of restructuring, redesigning or replacing the officer promotion system with one that promotes officers by PMOS. The Marine Corps officer promotion system is linked directly to aggregate vacancies and not to requirements. Vasquez and Williams argue that the current promotion system retains the "best and most fully qualified" Marine officers, but that the current system impedes PMOS proficiency and experience. Vasquez and Williams examined the Army, Navy and Air Force officer promotion systems and compared them to the Marine Corps'. The Army faces a significant challenge as it tries to bring back equity to its officer promotion system. In previous years combat career fields dominated promotion boards, while combat support career fields had below-average selection rates.

Currently, the Army is promoting officers by career field. An officer with an average performance record is guaranteed opportunities for promotion based on his or her non-operational career field because fewer officers are competing for promotion in that career field. However, a "well-rounded" officer in an operational career field has a smaller opportunity for promotion. He is now competing with a larger number of officers for a smaller portion of the promotion spots because the current system limits the number of operational career field promotions. The study concluded that a promotion system such as the Army's has a perceived imbalance in promotion equity which may hinder the cohesion of the officer corps and would drastically shift the culture of the Marine Corps if adopted.

The Navy's officer promotion system is used to determine force structure required to meet their mission. The promotion system is designed to fill vacancies adequately with officers who have the right skill set by designator, while adhering to DOPMA constraints. The Navy promotion process selects officers by designator and the goal is to fill vacancies efficiently with the best, fully qualified personnel.

The Air Force's officer promotion system promotes the best-qualified and is very similar to the Marine Corps officer promotion system. The promotion histories of the two services are comparable because the war-fighting occupations of both branches fared better on promotion boards: pilots for the Air Force and combat arms (infantry, artillery, tanks, and amphibious assault vehicles) for the Marine Corps. The Air Force's promotion value premise is "equity based on best and fully qualified" because the majority of officers are grouped into unrestricted categories and promotions are generally made without regard to their PMOS, but pilots had higher promotion rates.

The study found that on average, the five-year selection rates for majors were not significantly different by PMOS in the Marine Corps and generally are within the DOPMA promotion opportunity guidelines. The combat arms communities were consistently above the DOPMA guidelines. However, there were five PMOSs that fell below 70% promotion rate, all of them belonging to the 75XX (pilots) occupational field. In addition, the study states that PMOSs listed on the precept have been inconsequential in affecting selection rates because the best and fully qualified are selected. Based on statutory considerations and lack of short-term results from transitioning to a PMOS-based promotion system, Vasquez and Williams conclude that it would not be in the best interest of the Marine Corps to restructure, redesign or replace the officer promotion system.

7. Study by Ergun (2003)

Ergun (2003) analyzed factors that affect career development of mid-grade officers in the Marine Corps by evaluating fitness reports, performance at TBS, retention, and promotion to O-4 and O-5 ranks. He examined over 28,000 observations contained in the MCCOAC data file and included all officer accessions between FY 1980 and FY 1999.

Ergun focused on seven commissioning sources:

1. Naval reserve Officer Training Corps – NROTC
2. Platoon Leaders Course – PLC
3. Officers Candidate Course – OCC
4. Marine Enlisted Commissioning and Education Program – MECEP
5. Enlisted Commissioning Program – ECP
6. Meritorious Commissioning Program – MCP
7. The United States Naval Academy – USNA

He focused on an officer's commissioning source and its effect on promotion. The study indicates an officer's commissioning source is an important determinant of officer performance and promotion. In addition, TBS class standing is a significant predictor of how well an officer will perform over his or her career.

Ergun used bivariate probit models with sample selection to determine the effects of each commissioning source on promotion rates. He found that OCC graduates have the highest promotion rate to O-4 and USNA and NROTC have the highest promotion rate to O-5. Officers who graduate from the USNA have better fitness reports during O-1 through O-4 ranks, but have lower promotion rates to O-4 than most of the other commissioning sources. He determined that prior enlisted Marine officers who were commissioned through MECEP or ECP have the lowest O-5 promotion rates.

8. Study by Morgan (2005)

Morgan (2005), using the same data set used by Ergun (2003), provided research focusing on the relationship between selection to major and the survival of officers to the promotion point of major in the Marine Corps, focusing on whether billet assignments affected promotion or retention rates. More specifically, he studied whether the percentage of time spent in Fleet Marine Force (FMF) billets or in PMOS billets affected promotion and retention rates. In addition, Morgan analyzed the influence on promotion and retention of serving in combat or on a "B" billet such as recruiting duty, security forces, or drill field duties.

He used probit regression models to determine the influence of billet assignments on the probability of being selected for promotion. Morgan used Heckman's correction to account for selection bias and Cox proportional-hazard regression to identify the

influence of billet assignments on the likelihood of attrition. The findings indicate that if an officer spends more that 60% of his or her career in billets within their PMOS or in the FMF then he/she is less likely to be promoted or stay until 10 YCS. Also, if an officer spent any time in a "B" billet, then he/she is more likely to stay until 10 YCS.

C. RETENTION

1. Study by Theilmann (1990)

Theilmann (1990) studied factors that affect retention of Marine Corps officers using responses from the 1985 Department of Defense (DoD) Survey of Officer and Enlisted Personnel and the officer master file from DMDC. Logistic regression was used to measure the effects of independent variables on retention. Theilmann's retention model included demographic and biographic characteristics, tenure data, perception of external job opportunities, and satisfaction with military life. The model used in this study can project retention rates for every PMOS and identify critically short PMOSs.

The study identified several variables that are significant in determining retention rates or propensity to remain on active duty and they included: marital/dependent status, commissioning source, PMOS, race and satisfaction with intrinsic and extrinsic aspects of military life. He broke down PMOSs into four categories: combat arms, combat support, pilots and NFO's, and aviation support. The officers in combat arms, had the highest retention rates, while those in combat support had the lowest retention rate followed by aviation support, pilots and NFO's. The combat support variable was significant at the 5% level, the other variables were not significant at any of the usual levels. An officer with a combat support PMOS was 15.3% less likely to remain on active duty than an officer with a combat arms PMOS. Theilmann concluded that combat support and pilots have lower retention rates because their skills are easily transferable to the private sector.

2. Study by Demirel (2002)

Demirel (2002) examined the effects of commissioning sources across all branches of service on retention patterns at the end of initial obligation and at ten-years of service, which is when officers are in zone for promotion to O-4. The data set used to analyze officer retention was provided by DMDC and contained longitudinal information on officers who entered active duty between 1985 through 1995.

Demirel used logistic regression models to analyze retention of officers who were at their initial obligation point and those officers at ten years of service. He found that there were significant differences among commissioning sources across all the services. In addition, the direction of the retention effect varied across the services for each of the commissioning sources. In the Marine Corps, OCS graduates and officers who receive a direct appointment were more likely to remain beyond initial obligation than ROTC scholarship graduates. For all services he found that academy graduates, direct appointees and prior-service officers were more likely to stay beyond the ten-year decision point.

3. Study by Ergun (2003)

Ergun (2003) analyzed the MCCOAC data file to determine factors that affect selection rates in order to explain whether commissioning source affects retention patterns of mid-grade officers. Using bivariate probit models to estimate the effects of independent variables on the dependent variable, he showed that commissioning source is significant in predicting retention rates of Marine Corps officers. Ergun found officers commissioned through the PLC are 20.5% less likely to reach the ten-year decision point and officers who attended OCC 25% less likely than USNA graduates. Ergun was able to show that if an officer was married at the time of commissioning, then he/she was 18.1% more likely than an officer who was not married at the time of commissioning to reach the ten-year decision point.

When compared to the base case of combat arms PMOSs, he found that occupational fields significantly impact stay or leave decisions at the 1% significance level. Ergun found that ground support PMOSs are 14% less likely to reach the ten-year decision point; aviation PMOSs are 32% more likely, aviation support PMOSs are 10.6% less likely, and service PMOSs are 9.6% less likely to reach the ten-year decision point then officers in a combat arms PMOS.

4. Study by Hoglin (2004)

Hoglin (2004) again used the MCCOAC data file to analyze survival patterns of Marine Corps officers and to develop an accession plan for prior and non-prior enlisted officer candidates. He used Cox Proportional Hazard models to estimate the effects of independent variables in order to predict survival patterns. In addition, he used a Markov

model to estimate prior service transition and combined fiscal data to optimize the number of prior and non-prior enlisted officer candidates.

Hoglin found that prior enlisted officers have a higher survival rate than non-prior enlisted officers. The non-parametric model results show the optimal number of prior enlisted officer accessions is lower than suggested by historical trends and differs across PMOSs. Additionally, he found that officers who are married, commissioned through MECEP, graduate in the top third at TBS, and are assigned a PMOS in a combat support occupational field have a higher survival rate than unmarried USNA graduates who graduate in middle third at TBS, and are assigned a combat or combat service support PMOS. Table 5 lists PMOSs and occupational fields Hoglin used to determine survival patterns.

Table 5. Primary Military Occupational Specialties Assigned to Occupational Fields

MOS	**Description**	**MOS**	**Description**
Combat Arms Occupational Group			
03XX	Infantry	08XX	Artillery
18XX	Tank & Assault Amphibian Vehicle		
Combat Support Occupational Group			
MOS	**Description**	**MOS**	**Description**
02XX	Intelligence	05XX	Marine Air Ground Task Force Plans
13XX	Engineer, Construction, Facilities and Equipment	21XX	Ordinance
23XX	Ammunition and EOD	25XX	Operational Communication
26XX	Signals Intelligence / Ground Electronics	60/61XX	Aircraft Maintenance
63/64XX	Avionics	65XX	Aviation Ordinance
72XX	Air Control / Air Support / Anti-Air Warfare / Air-Traffic Control	73XX	Navigation Officer /Enlisted Flight Crews
75XX	Naval Pilots / Naval Flight Officers		
Combat Service Support Occupational Group			
01XX	Personnel / Administration	04XX	Logistics
06XX	Command and Control Systems	11XX	Utilities
28XX	Ground Electronic Maintenance	30XX	Supply Administration
31XX	Traffic Management	33XX	Food Service
34XX	Financial Management	35XX	Motor Transport
40XX	Data Systems	41XX	Marine Corps Exchange
43XX	Public Affairs	44XX	Legal Service
46XX	Visual Information	55XX	Music
57XX	Nuclear, Biological and Chemical	58XX	Military Police

MOS	Description	MOS	Description
59XX	Electronics Maintenance	66XX	Aviation Logistics
68XX	Meteorological & Oceanographic	70XX	Airfield Services

(Source: From O'Brien via Hoglin, 2002)

5. Study by Korkmaz (2005)

Korkmaz (2005) created a data file from the Navy Officer Data Card information and promotion data to compile a data file that contains officer cohorts who accessed during 1983 through 1990. The data set was used to conduct a survival analysis. He focused on identifying factors that affect the longevity of naval officers' careers, and narrowed his research to evaluate the effects of commissioning source on retention. He used three SAS survival analysis procedures (LIFETEST, LIFEREG, and PHREG) to examine the factors that affect survival patterns of Navy officers.

Korkmaz found that commissioning source is a significant predictor of survival for Navy officers and his results are the similar to Ergun. In addition, he found that USNA graduates have a better survival rate than the other commissioning sources. Also, the results indicate that females and African-Americans have better survival rates than males and Caucasians. The results of the SAS LIFETEST procedure show that survival rates among officers with different commissioning sources are not the same. Officers commissioned through NROTC have the lowest survival function and USNA graduates had the highest.

Korkmaz used Kaplan-Meier methods to estimate the survival functions associated with the different designators and found that the survival functions are not the same. He found that aviators had the highest survival function and Surface Warfare and Submarine officers had the lowest survival function. Korkmaz analyzed the Special Warfare community after officers served 100 months and concluded that this group had the highest survival function, followed by officers with a medical designator.

E. CHAPTER SUMMARY

The literature that emphasizes retention and promotion of mid-grade officers in the Marine Corps has routinely provided similar results. Some of the significant variables that predict promotion and survival probabilities include marital status, gender, commissioning source, GCT score and class standing at TBS. Most researchers combine

PMOSs into four or five categories in order to determine whether they significantly influence the promotion probability. The occupational fields are usually divided into four or five categories. However, limited research exists on the significance of PMOS because available research places PMOSs into occupational field groupings and even less research specifically addresses PMOS as a key predictor in promotion models.

There are conflicting results in the literature when researchers analyze retention rates among Marine Corps officers, when the focus is on occupational fields or PMOSs. Some studies indicate that occupational fields do not significantly affect survival patterns and others show that officers in a combat service or combat support occupational field would have higher survival rates than officers in a combat arms occupational field. The literature provides a solid starting point for inclusion of candidate explanatory variables into the models developed in this study to determine if PMOS affects retention and promotion rates of mid-grade officers in the Marine Corps.

IV. DATA AND PRELIMINARY ANALYSIS

> In moments of panic, fatigue or disorganization, or when something out of the ordinary has to be demanded from [his troops], the personal example of the commander works wonders, especially if he has had the wit to create some sort of legend round himself.
>
> - Erwin Rommel: The Rommel Papers, ix, 1953

This chapter describes the data used to conduct the preliminary statistical analysis. In addition, this chapter describes the dependent and explanatory variables used in those models, along with initial descriptive statistics. The purpose of the preliminary analysis is to evaluate PMOSs in terms of continuation and promotion patterns using three models: retention to 10 YCS, promotion to O-4 and promotion to O-5. This chapter will review how effectively the promotion process matches requirements established by the GAR with critically short PMOSs listed on precepts.

A. DATA

The retention and promotion models were developed from two different data sets: (1) the Marine Corps Commissioned Officer Accession Career (MCCOAC) data file; and (2) the Marine Officer Cohort data file. The Marine Officer Cohort data file was used primarily to obtain or update missing information from the MCCOAC data file.

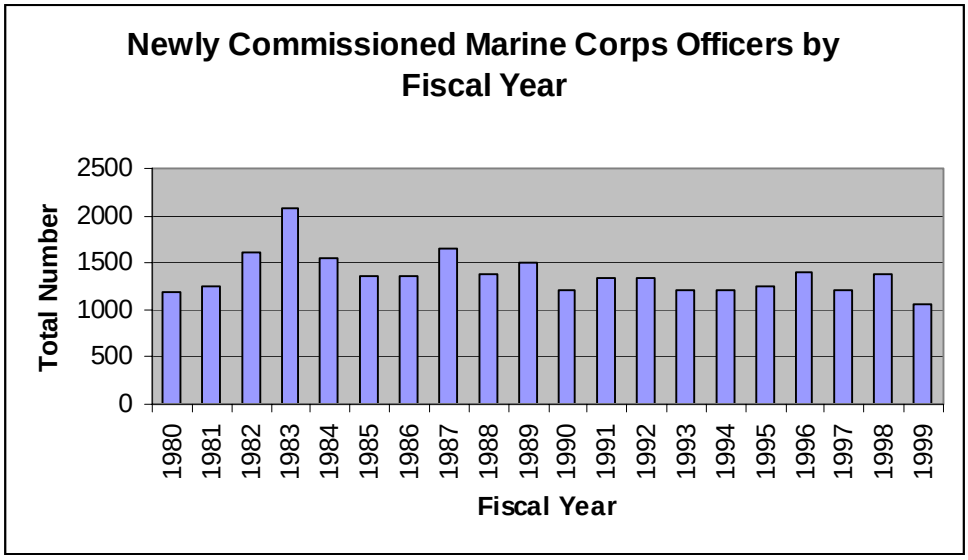
1. MCCOAC Data File

The MCCOAC data file is a longitudinal file in which event-based variables are recorded starting at the time of commissioning and continuing through separation. The data file contains information through the rank of O-5, except that the last pay grade variable shows whether an officer was promoted to O-6. The data file contains cohort information from FY 1980 through FY 1999 and includes 27,659 observations. The number of commissioned officers by cohort fiscal year is presented in Figure 9. The average cohort size was 1,383 officers with a low of 1,061 in FY 1999 and a high of 2,074 in FY 1983.

The MCCOAC file provides demographic information that includes gender, ethnic group, race, marital status, and number of dependents. The data file also contains commissioning information that includes commissioning source, commissioning age,

commissioning date and fiscal year commissioned. In addition, the data contain general information from TBS such as FY attended and class size. The TBS data provides officer performance variables that include class standing, overall GPA, academic GPA, leadership GPA, military skills GPA, and the third of the TBS class in which the officer graduated. Starting in fiscal year 1995, the MCCOAC data file contains the top three PMOS preferences an officer selects while at TBS. The PMOS preferences and TBS class standing factor into the assignment process along with classification plans and school seats available. The PMOS requirements produced by the GAR report are used to develop the classification plans.

Figure 9. Newly Commissioned Marine Corps Officers By Fiscal Year



(Source: Author, 2005)

The MCCOAC data file updates twenty-five variables as officers are promoted. There are twelve variables that update pistol and rifle qualifications and four showing the results of an officer's physical fitness test. The remaining variables include the number of dependents, marital status, PMOS, date of rank (DOR), fiscal year associated with promotion, geographic location, primary monitored command code (PMCC), and reporting unit code (RUC).

Finally, the MCCOAC data file contains information based on the last Headquarters Master File (HMF) record. These variables include date of rank (DOR), pay grade, PMOS, component code, college major, education code, and separation date. In addition, this data file contains variables that record whether an officer survived until a

specific year of service. The MCCOAC data file was last updated by the HMF and the Accession Retention Statistic Tracking (ARSTAT) file on 30 December 2004.

2. DMDC Marine Officer Cohort Data File

The DMDC Marine Officer Cohort data file contains longitudinal data on cohorts from FY 1980 through FY 2001. The data file was updated annually through 31 December 2004 by multiple data bases used by DMDC. The variables used in the DMDC data file are identical or very similar to those in the MCCOAC data file. The data file contains demographic information, commissioning information, PMOS, months in grade, years of commissioning service, entry age and separation age. In addition, the data file contains information at each grade change, as the MCCOAC file does. Since DMDC is the official manpower record-keeping agency for the military, information missing from the MCCOAC file was obtained through cross-referencing the DMDC Marine Officer Cohort data file.

B. SAMPLES USED IN STATISTICAL ANALYSIS

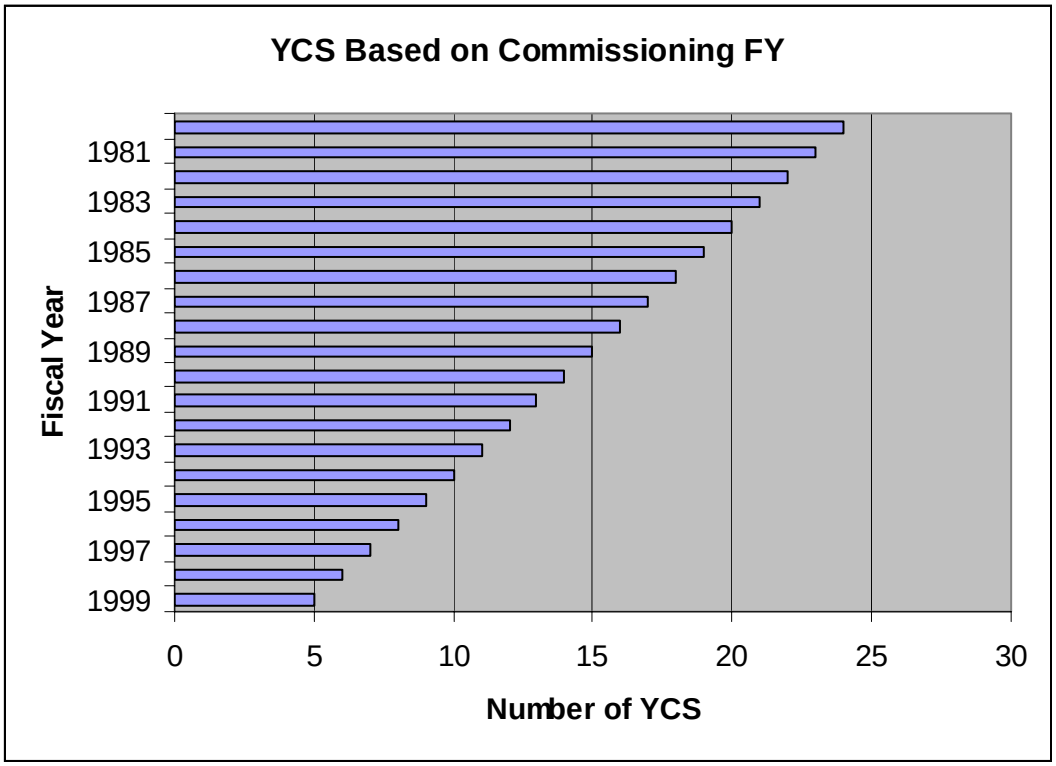
The techniques used to analyze effects of PMOS on retention and promotions utilize different samples because the model examines data at different times in an officer's career. The retention model examines officers based on whether they survived to 10 years of commissioned service. There are 27,659 observations available in total, but only 11,570 officers survived to 10 YCS. The remaining officers have voluntarily or involuntarily separated or are currently on active duty in the Marine Corps, but have not yet reached 10 YCS.

The promotion models examine officers based on whether they survive to the commencement of the O-4 or O-5 promotion board. The unrestricted grade shaping pyramid shows that officers are eligible for promotion to O-4 at around 10 YCS and promotion to O-5 at around 16 YCS. Each fiscal year was examined to determine the first officer promoted to O-4 or O-5 in order to identify the shortest number of months to reach the next rank. The promotion board usually convenes one year prior to the first officer being promoted in any given fiscal year. Next, thirteen months was subtracted from the promotion date of the first officer promoted in a fiscal year to determine whether an officer survived to the commencement of the promotion board. Therefore,

only officers who have 10 YCS are included in the O-4 promotion model and only those with approximately 16 YCS are included in the O-5 promotion model.

Cohorts from fiscal year 1980 through 1993 are used to develop the O-4 promotion model. The average time until promotion to O-4 is 128 months or 10.67 years. There are 9,908 officers on the data who were promoted to O-4. The cohorts used to examine the promotion to O-5 model include FY 1980 through FY 1988. The average promotion time to O-5 is 200 months or 16.67 years. There are 3,821 officers in the data who were promoted to O-5. Figure 10 shows the relationship between YCS and fiscal year commissioned.

Figure 10. Number of Years Commissioned Based on Commissioning FY



(Source: Author, 2005)

1. The Sample for 10 YCS Retention Model

The 10 YCS retention model analyzes officers commissioned between FY 1980 and FY 1994. Table 6 describes the sample used in the 10 YCS retention model. The cohort data for officers commissioned between FY 1980 and FY 1993 consists of 19,310 observations. In order to analyze retention and voluntary survival behaviors efficiently,

all officers with involuntary separation codes were deleted from the model. Involuntary separation includes separation for legal issues, medical reasons, failure at either TBS or PMOS school, failure to select for O-2 or O-3.

Table 6. The Sample for the 10 YCS Retention Model

Details	**Number**	**% Initial Cohort**
Total observations in FY 1980 – FY 1994	19,310	100.00
Officers who were involuntarily separated: deleted	2,700	13.98
Cases missing other data used in the model or voluntary separations: deleted	5,389	27.91
Sample used to analyze 10 YCS Retention Model	**11,221**	**58.11**

(Source: Author, 2006)

The MCCOAC file does not accurately depict the correct number of months from commissioning to each rank and the SURVIVE_10 (survive to 10 YCS) variable does not accurately depict the correct number of officers who survived to 10 YCS. Because the number of commissioning months was incorrect, thus resulting in a zero for the SURVIVE_10 variable, when in fact that officer had survived to 10 YCS and the value should have been a one. For example, an officer who had a date of rank sixteen years after he/she was commissioned would have a zero for the SURVIVE_10 variable. The number of commissioned months was corrected by utilizing commissioning dates, date of ranks and separation dates.

2. The Sample for the O-4 Promotion Model

The O-4 promotion model uses the same cohorts used in the retention model. The cohort data for officers commissioned between FY 1980 and FY 1994 consist of 21,153 observations. Each fiscal year had different averages for the number of months to reach O-4 because the board convening date in some fiscal years occurred after ten YCS and other during the ninth YCS. The basis of the O-4 promotion model relies on whether an officer survived to the O-4 promotion board. Table 7 describes the O-4 promotion model.

Table 7. The Sample for the O-4 Promotion Model

Details	**Number**	**% Initial Cohort**
Total observations in FY 1980 – FY 1994	21,153	100.00
Cases missing other data used in the model or voluntary separations: deleted	9,377	44.33
Total number of officers who survived to O-4 Board	**11,776**	**55.67**
Total number accepting promotion to O-4	**9,669**	**45.71**
O-4 Promotion Rate	**82.11%**	

(Source: Author, 2006)

The MCCOAC file does not include a promotion variable; however other variables within the data file were used to determine whether an officer was promoted to O-4. First, the Time_O4 variable gives the number of months from commissioning to promotion to O-4. Second, the DOR_O4 variable, date of rank for O-4, provides the exact date of promotion. Next, the L_PG variable indicates the last rank obtained before separation or the rank obtained before December 31, 2004. Finally, the O4_PMOS variable indicates the PMOS as an O-4. These variables were used to verify promotion to O-4 and to validate the correct number of commissioning months. The DMDC Marine Officer Cohort Data File was used to verify data missing from the MCCOAC file such as the number of months to promotion and PMOS information at different ranks.

3. The Sample for the O-5 Promotion Model

The O-5 promotion model uses cohort data for officers commissioned between FY 1980 – FY 1988 and consists of 13,374 observations. The commencement of the O-5 promotion board usually occurs around fifteen years of commissioned service. The O-5 promotion model relies on whether an officer survived to the O-5 promotion board. In order to determine whether an officer was promoted to O-5 the same matching techniques as in the O-4 promotion model were used. Table 8 describes the sample used in the O-5 promotion model.

Table 8. The Sample for the O-5 Promotion Model

Details	**Number**	**% Initial Cohort**
Total observations in FY 1980 – FY 1988	13,374	100.00
Cases missing other data used in the model or voluntary separations: deleted	7,637	57.10
Total number of officers who survived to O-5 Board	**5,737**	**42.90**
Total number accepting promotion to O-5	**3,760**	**28.11**
O-5 Promotion Rate	**65.54%**	

(Source: Author, 2006)

C. VARIABLE DESCRIPTIONS

The retention and promotion models each use one dependent variable in the statistical analysis. A brief description and discussion of the dependent variables is presented in the next section. The explanatory variables are described together in the following section. In addition, a description of each PMOS used or excluded from the

models is discussed along with clarification on which PMOSs have changed, merged or no longer exist.

1. The Dependent Variables

a. The 10 YCS Retention Model

The dependent variable used in the retention model represents whether an officer survived to 10 years of commissioned service. In order to determine an officer's survival, the "num_mon" variable from the MCCOAC data file was used. If the number of months was greater than or equal to 120, then the officer presumably survived to 10 years of service. The dependent variable "stay" equals '1' if the num_mon is greater than 119 months of commissioned service and '0' if it is less than 120. The survival model utilizes the same dependent variable and determines the differences in survival patterns between PMOSs and occupational fields. Table 9 descibes the dependent variable used in the 10 YCS Retention Model.

Table 9. Dependent Variable Used in the 10 YCS Retention Model.

Description of Variable	Variable	Variable Type	Binary Outcome
Officer Survived to 10 YCS	Stay	Binary	= 1 if num_mon is >= 120 = 0 if num_mon is < 120

(Source: Author, 2006)

b. The O-4 and O-5 Promotion Models

In order to analyze patterns for promotion to O-4 and O-5 a two-step process was utilized. First, a binary variable, Survived_O4brd or Survived_O5brd, was created for those officers who survived to the commencement of the O-4 or O-5 promotion board. Next, another binary variable was created to determine if those observations accepted promotion to O-4 or O-5 by using several other variables in the MCCOAC data file: time to the next rank, DOR, PMOS at the next rank, and last pay grade attained. Tables 10 and 11 describe the dependent variable used in the promotion models and the variables used to determine which observations survived to commencement of the promotion boards.

Table 10. Dependent Variables Used in the O-4 Promotion Model

Description of Variable	Variable	Variable Type	Binary Outcome
Survived to the O-4 Promotion Board	Survived_O4brd	Binary	= 1 if num_mon minus 13 was greater than that value for the first officer promoted in each fiscal year = 0 otherwise
Promoted to O-4	PROMO4	Binary	= 1 if the officer's record contained values for Time_O4 , DOR O-4, O-4 PMOS and L_Rank >= O-4 = 0 otherwise

(Source: Author, 2006)

Table 11. Dependent Variables Used in the O-5 Promotion Model

Description of Variable	Variable	Variable Type	Binary Outcome
Survived to the O-5 Promotion Board	Survived_O5brd	Binary	= 1 if num_mon minus 13 was greater than that value for the first officer promoted in each fiscal year = 0 otherwise
Promoted to O-5	PROMO5	Binary	= 1 if the officer's record contained values for Time_O5 , DOR O-5, O-5PMOS and L_PG >= O-5 = 0 otherwise

(Source: Author, 2006)

2. The Independent Variables

The independent variables include demographic information, commissioning source, performance at TBS, PMOS, and fiscal year commissioned. The base case is a single white male who did not have prior service, who was commissioned through PLC, finished in the top third at TBS, held an 0302 (Infantry) PMOS, and was commissioned in FY 1980. Descriptions of the independent variables used in the retention and promotion models are shown in Table 12.

Table 12. Independent Variable Descriptions

Category	Variable Description	Variable	Variable Type	Range
Gender	Female	Female	Binary	= 1 if Female = 0 otherwise
Ethnicity	Hispanic	Hispanic	Binary	= 1 if Hispanic = 0 otherwise
	African-American	Africaamer	Binary	= 1 if Africanamer = 0 otherwise
	Other Ethnicity	Otherethnic	Binary	= 1 if Otherethnic = 0 otherwise
Marital Status	Married	Married	Binary	= 1 if Married = 0 otherwise
Commissioning Age (years)	Commissioning Age	Comm_Age	Continuous	17 – 35
Commissioning Source	Officer Candidate School	OCC	Binary	= 1 if OCC = 0 otherwise
	Naval Reserve Officer Training Corps	NROTC	Binary	= 1 if NROTC = 0 otherwise
	United States Naval Academy	USNA	Binary	= 1 if USNA = 0 otherwise
	Marine Enlisted Commissioning & Education Program	MECEP	Binary	= 1 if MECEP = 0 otherwise
	Enlisted Commissioning Program	ECP	Binary	= 1 if ECP = 0 otherwise
Whether an officer was prior enlisted	Prior Enlisted	Priorenl	Binary	= 1 if Priorenl = 0 otherwise
TBS Thirds	Finished in Middle Third at TBS	TBS_Mid	Binary	= 1 if TBS_Mid = 0 otherwise
	Finished in Bottom Third at TBS	TBS_Bot	Binary	= 1 if TBS_Bot = 0 otherwise
TBS Percentile	TBS Overall Class Standing Percentile	TBSPer	Continuous	0 – 100

Category	Variable Description	Variable	Variable Type	Range
Fiscal Year Commissioned	Fiscal Year Commissioned FY 1980 – FY 1999 (Base case FY 1980)	FY_81	Binary	= 1 if FY_81 = 0 otherwise
The Primary Military Occupational Specialty to which an officer is assigned	PMOS (Each PMOS has a separate variable) 0302 (Infantry) is the base case	Example: Adjutant (PMOS is 0180)	Binary	= 1 if Adjutant = 0 otherwise
The Occupational Group to which an officer belongs	Ground Support Occupational Field contains six PMOSs (Each Occupational Group has a separate variable.) Combat Arms is the base case.	Example: Ground Support	Binary	= 1 if Ground Support = 0 otherwise

(Source: Author, 2006)

3. Description and Clarification of PMOSs

The Marine Corps classifies its officers into occupational fields and PMOSs. The Military Occupational Specialties Manual (MOS Manual) "identifies and codifies the personnel skill requirements, derived through the Expeditionary Warfare Development System. The Occupational System enables the Human Resource Development Process to maintain personnel inventory to meet the needs of the force."[45] Since the time period studied, some PMOSs have changed, merged or no longer exist. Table 13 describes the PMOSs used in the models as well as the changes that have occurred since 1980. The retention model focuses on the officers' last PMOS attained and the promotion models focus on the PMOS prior to promotion.

[45] Military Occupational Specialties Manual (MOS Manual), MCO P1200.16, 18 April 2005, p.V.

Table 13. PMOS Descriptions Used in the Model and History

Occupational Field / Group	PMOS	Description	Notes
01 / Service Support	0180	Adjutant	-
02 / Ground Support	0202	Marine Air Ground Task Force Intelligence Officer	OccFld '02' merge to 0202 when promoted to O-4
	0203	Ground Intelligence Officer	-
	0204	Human Source Intelligence Officer	-
	0206	Signals Intelligence/ Ground Electronic Warfare Officer	PMOS 2602 converted to 0206
03 / Combat Arms	0302	Infantry	-
04 / Ground Support	0402	Logistics Officer	PMOS 3502 converted to 0402
06 / Ground Support	0602	Communications Officer	PMOSs 2502 and 4002 were converted to 0602
03 / Combat Arms	0302	Infantry	-
04 / Ground Support	0402	Logistics Officer	PMOS 3502 converted to 0402
06 / Ground Support	0602	Communications Officer	PMOSs 2502 and 4002 were converted to 0602
08 / Combat Arms	0802	Artillery Officer	-
13 / Ground Support	1302	Combat Engineer Officer	-
18 / Combat Arms	1802	Tank Officer	-
	1803	AAV Officer	-
30 / Ground Support	3002	Supply Officer	-
34 / Service Support	3402	Finance Officer	-
43 / Service Support	4302	Public Affairs Officer	-
44 / Service Support	4402	Judge Advocate	-
58 / Ground Support	5803	Military Police Officer	-
60 / Aviation Support	6002	Aircraft Maintenance	-
66 / Aviation Support	6602	Aviation Supply Officer	PMOS 3060 converted to 6602
72 / Aviation Support	7202	Air Command and Control Officer	OccFld '72' merge to 7202 when promoted to O-4
	7204	Low Altitude Air Defense Officer	-
	7208	Air Support Control	-
	7210	Air Defense Control Officer	-

Occupational Field / Group	PMOS	Description	Notes
	7220	Air Traffic Control Officer	-
75 / Aviation Fixed	7501	A – 4 Pilot	No longer exists
	7509	AV-8B Pilot	-
	7522	F-4 Pilot	No longer exists
	7523	F/A-18 Pilot	-
	7525	F/A-18 NFO Weapons System Officer	-
	7543	EA-6B Pilot	-
	7557	C-130 Pilot	-
	7576	OV-10 Pilot	No longer exists
	7583	A-6E Bombardier/Navigator	No longer exists
	7584	EA-6A Electronic Warfare Officer	No longer exists
	7588	EA-6B NFO Electronic Warfare Officer	-
	7598	Basic Fixed Wing	-
75 / Aviation Rotary	7532	V-22 Pilot	-
	7562	CH-46 Pilot	-
	7563	UH-1 Pilot	-
	7564	CH-53 A/D Pilot	-
	7565	AH-1 Pilot	-
	7566	CH-53E Pilot	-
	7597	Basic Rotary Pilot	-
Training	7599	Basic Flight Student at TBS	-
	9901	Basic Officer	-

(Source: Author, 2006)

D. PRELIMINARY ANALYSIS

This section reports preliminary statistics for the retention and promotion models. Tables 14 through 19 show the number of observations, proportion, and standard deviation for the retention and promotion models. The proportion for binary variables shows the percentage of observations whose value is 1. For example the percentage of infantry officers who survived until 10 YCS is 57.6%, as shown in Table 15.

1. Retention to 10 YCS

The retention rate for the 10 YCS Retention Model is 58.11%, which shows that 11,221 observations out of 19,310 voluntarily stayed until 10 years of commissioned

service. Table 14 compares the proportions of officers who stayed among the six occupational groups. The chi-squared test shows that occupational fields and retention are not independent. The data includes the whole population of interest. However, the tests make sense if it is hypothesized that the data are like a random sample from a conceptual population of officers. Officers in the Aviation Rotary occupational group had the highest survival rate at 78.0% and those in the Ground Support occupational group had the lowest survival rate at 52.6%.

Table 15 compares the proportion of officers who stayed among the fifty-one PMOSs and compare them to those officers who left. The chi-squared test shows that PMOSs and retention are not independent. Officers with the following PMOSs had the highest survival rate within their occupational group: 0302 (Infantry Officer), 4002 (Data Systems Officer), 4302 (Public Affairs), 7523 (F/A 18 pilot), 7565 (AH-1 pilot) and 7220 (Air Traffic Control Officer).

Table 14. 10 YCS Retention Rates by Occupational Group

Occupational Group	N	Proportion	Chi-Square	Prob
1 – Combat	5,169	.530	716.545	<.0001
2 – Ground Support	5,741	.526		
3 – Service Support	1,681	.543		
4 – Aviation Fixed	2,714	.696		
5 – Aviation Rotary	2,778	.781		
6 – Aviation Support	1,439	.532		

(Source: Author, 2006)

Table 15. 10 YCS Retention Rates by PMOS

Occupational Group / PMOS	N	Proportion	Chi-Square	Prob
Combat			723.159	<.0001
0302	3223	.576		
0802	1589	.523		
1802	390	.551		
1803	234	.556		
Ground Support				
0202	372	.591		
* 0203	37	.297		
* 0204	8	.125		
* 0206	82	.549		
* 0207	19	.263		
0402	1319	.503		

Occupational Group / PMOS	N	Proportion
0602	755	.523
1302	618	.532
2502 (0602)	317	.565
2602 (0202)	81	.5936
3002	996	.435
3502 (0402)	258	.457
4002 (0602)	102	.647
5803	206	.592
0180	333	.517
Service Support		
3404	375	.499
4302	82	.524
4402	671	.489
Aviation Student		
7599 (Flight Student)	4099	.699
Aviation - Fixed		
** 7501	61	.410
7509	61	.689
* 7522	97	.660
7523	64	.781
7525	176	.756
7543	48	.500
7556	94	.415
7557	30	.467
** 7576	35	.400
*** 7581	42	.786
** 7583	40	.850
** 7584	12	.833
7588	147	.776
7598 (Basic Fixed)	222	.469
Aviation - Rotary		
7562	317	.757
7563	86	.756
7564	159	.635
7565	139	.813
7566	100	.780
7597 (Basic Rotary)	156	.744
Aviation Support		
3060 (6602)	96	.583
6002	272	.585
6602	157	.446
7202	110	.464
**** 7204	218	.578

Occupational Group / PMOS	N	Proportion
**** 7208	239	.498
**** 7210	196	.515
**** 7220	50	.680

(Source: Author, 2006)

* Occupational Field '02' converts to 0202 once promoted to O-4.
** PMOSs that no longer exist.
*** 7581 is a Basic Naval Flight Officer, converts to 7525 or 7588 once qualified.
**** Occupational field '72' all convert to 7202 once promoted to O-4.

2. Promotion to O-4

Of the initial sample, 55.7% of population survived until the O-4 promotion board; 9,669 out of 11,776 (82.1%) of the initial sample were promoted to O-4. Table 16 shows the proportion of officers who survived the commencement of the O-4 promotion board and compares those who were and were not promoted among the six occupational groups. The chi-square test shows that promotion to O-4 and occupational field are not independent. Officers in the Service Support occupational group had the highest promotion rate at 85.4% and those in the Aviation Fixed Wing occupational group had the lowest promotion rate at 73.6%.

Table 17 analyzes the proportion of officers promoted who survived to the commencement of the O-4 promotion board with those officers who were not selected among the forty-two PMOSs. The O-4 Promotion Model used the O3_PMOS variable to analyze promotion patterns. Officers with the following PMOSs had the highest promotion rate within their occupational group: 1803 (Amphibious Assault Vehicle Officer), 0206 (Signals Intelligence Officer), 4402 (Judge Advocate), 7525 (F/A-18 NFO Weapons System Officer), 7565 (AH-1 pilot) and 7220 (Air Traffic Control Officer). The chi-square test shows that promotion to O-4 and PMOSs are not independent.

Table 16. O4 Promotion Rates by Occupational Group

Occupational Group	N	Proportion	Chi-Square	Prob
1 – Combat	2775	0.851	154.173	<.0001
2 – Ground Support	3079	0.852		
3 – Service Support	940	0.854		
4 – Aviation Fixed	1963	0.736		
5 – Aviation Rotary	2248	0.795		
6 – Aviation Support	771	0.840		

(Source: Author, 2006)

Table 17. O4 Promotion Rates by PMOS

Occupational Group / PMOS	N	Proportion	Chi-Square	Prob
Combat			255.002	<.0001
0302	1819	0.862		
0802	791	0.856		
1802	208	0.846		
1803	128	0.875		
Ground Support				
0202	366	0.833		
* 0203	9	0.889		
* 0206	46	0.957		
* 0207	9	0.889		
0402	860	0.865		
0602	688	0.826		
1302	335	0.854		
3002	473	0.818		
5803	134	0.866		
Service Support				
0180	227	0.789		
3404	193	0.829		
4302	61	0.852		
4402	367	0.872		
Aviation - Fixed				
** 7501	39	0.692		
7509	417	0.676		
** 7522	116	0.741		
7523	499	0.749		
7525	116	0.871		
7543	140	0.657		
7556	230	0.687		
7557	75	0.640		
** 7576	32	0.781		
** 7583	63	0.825		
** 7584	14	0.787		
7588	156	0.782		
Aviation - Rotary				
7532	1	1.000		
7562	936	0.795		
7563	309	0.809		
7564	290	0.745		
7565	437	0.856		
7566	363	0.802		
Aviation Support				
6002	176	0.852		

Occupational Group / PMOS	N	Proportion
6602	148	0.804
7204	137	0.854
**** 7208	135	0.844
**** 7210	139	0.871
**** 7220	36	0.944

(Source: Author, 2006)
* Occupational Field '02' converts to 0202 once promoted to O-4.
** PMOSs that no longer exist.
*** 7581 is a Basic Naval Flight Officer, converts to 7525 or 7588 once qualified.
**** Occupational field '72' all convert to 7202 once promoted to O-4.

3. Promotion to O-5

Of the initial sample, 42.9% of population survived until the O-5 promotion board; 3,760 out of 5,737 (65.5%) of the initial sample were promoted to O-5. Table 18 shows the proportion of officers who survived the commencement of the O-5 promotion board and compares the numbers of officers who were and were not promoted among the six occupational groups. The chi-square test shows that the promotion to O-5 and occupational fields are not independent. Officers in the Service Support and Aviation Support occupational groups had the highest promotion rates at 68.0% and those in the Ground Support occupational group had the lowest promotion rates at 61.4%. Table 19 shows the proportion of officers who survived the commencement of the O-5 promotion board and the numbers of officers promoted and not selected among the thirty-eight PMOSs. The chi-square test shows that the promotion to O-5 and PMOSs are not independent.

The O-5 Promotion Model used the O4_PMOS variable to analyze promotion patterns. Officers with the following PMOSs had the highest promotion rate within their occupational group: 0302 (Infantry Officer), 5803 (Military Police Officer), 4402 (Judge Advocate), 7523 (F/A 18 pilot), 7565 (AH-1 pilot) and 7210 (Air Defense Control Officer). Tables 20 through 22 provide a brief overview of the preliminary analysis for the retention and promotion models

Table 18. O5 Promotion Rates by Occupational Group

Occupational Group	N	Proportion	Chi-Square	Prob
1 – Combat	1509	0.677	21.395	0.0007
2 – Ground Support	1555	0.614		
3 – Service Support	493	0.684		
4 – Aviation Fixed	738	0.657		
5 – Aviation Rotary	1021	0.633		
6 – Aviation Support	413	0.685		

(Source, Author, 2006)

Table 19. O5 Promotion Rates by PMOS

Occupational Group / PMOS	N	Proportion	Chi-Square	Prob
Combat			85.149	<.0001
0302	956	0.697		
0802	402	0.687		
1802	110	0.664		
1803	67	0.597		
Ground Support				
0202	241	0.560		
* 0206	1	1.000		
0402	476	0.641		
0602	345	0.574		
1302	161	0.602		
3002	232	0.634		
5803	63	0.651		
Service Support				
0180	91	0.670		
3404	93	0.645		
4302	29	0.483		
4402	260	0.719		
Aviation - Fixed				
** 7501	3	1.000		
7509	174	0.649		
** 7522	8	1.000		
7523	218	0.720		
7525	68	0.632		
7543	29	0.690		
7556	11	0.636		
7557	91	0.560		
** 7576	17	0.647		
** 7583	14	0.857		
7588	91	0.582		

Occupational Group / PMOS	N	Proportion
Aviation - Rotary		
7562	410	0.641
7563	130	0.623
7564	101	0.683
7565	187	0.684
7566	190	0.568
Aviation Support		
6002	83	0.687
6602	69	0.725
7202	48	0.583
**** 7204	55	0.764
**** 7208	61	.607
**** 7210	71	.775
**** 7220	29	.621

(Source: Author, 2006)

* Occupational Field '02' converts to 0202 once promoted to O-4.

** PMOSs that do not exist.

*** 7581 is a Basic Naval Flight Officer, converts to 7525 or 7588 once qualified.

**** Occupational field '72' all convert to 7202 once promoted to O-4.

Table 20. Preliminary Overview for the Retention Model

	COMBAT	GRDSUP	SERSUP	FIXED WING	ROTARY WING	AVSUP
PMOS with the Highest Retention Rate	0302 (.576)	4002 (.647)	4302 (.524)	7523 (.781)	7565 (.813)	7220 (.680)
PMOS with the Lowest Retention Rate	0802 (.523)	3002 (.435)	4402 (.489)	7556 (.415)	7564 (.635)	6602 (.446)

(Source: Author, 2006)

Average Retention Rate for the 10 YCS Retention Model is .697.

Table 21. Preliminary Overview for the O-4 Promotion Model

	COMBAT	GRDSUP	SERSUP	FIXED WING	ROTARY WING	AVSUP
PMOS with the Highest O-4 Promotion Rate	1803 (.875)	0206 (.957)	4402 (.872)	7525 (.870)	7565 (.856)	7220 (.944)
PMOS with the Lowest O-4 Promotion Rate	1802 (.846)	3002 (.818)	0180 (.789)	7557 (.640)	7564 (.745)	6602 (.804)

(Source: Author, 2006)
* Average Promotion Rate for the O-4 Promotion Model is .821.
** The recommended promotion opportunity to O-4 according to DOPMA is .80.

Table 22. Preliminary Overview for the O-5 Promotion Model

	COMBAT	GRDSUP	SERSUP	FIXED WING	ROTARY WING	AVSUP
PMOS with the Highest O-5 Promotion Rate	0302 (.697)	5803 (.651)	4402 (.719)	7523 (.720)	7565 (.684)	7210 (.775)
PMOS with the Lowest O-5 Promotion Rate	1803 (.597)	0202 (.560)	4302 (.483)	7557 (.560)	7566 (.568)	7202 (.583)

(Source: Author, 2006)
* Average Promotion Rate for the O-4 Promotion Model is .655.
** The recommended promotion opportunity to O-5 according to DOPMA is .70.

4. Requirements and Critically Short PMOSs

The Marine Corps officer promotion system uses the GAR to determine requirements and critically short PMOSs (those below 85% of the required manning level). The promotion board precept publishes a list of critically short PMOSs, under the skill advice section. However, there are times when a PMOS is not listed on the precept,

but the current inventory is below the 85% requirement. According to Major Joseph Newcomb, Officer Promotion Planner, HQMC, if the number of officers in-zone for promotion, after applying the promotion opportunity, would yield enough selections to exceed the 85% requirement, then that PMOS is excluded from the skill section of the precept. Therefore, the PMOSs listed on the precept are indicative of the PMOSs that are truly critically short and will remain below 85% of the requirement, even after the promotion board, unless the promotion rate is higher than the promotion opportunity. Currently, the promotion opportunity is approximately 90% for O-4 and 70% for O-5. Tables 23 and 24 depict the number of times that a PMOS was critically short during fiscal years 1990 through 2005 and during fiscal years 2001 through 2005. Table 25 shows a list of PMOSs that were never critically short.

Table 23. O-4 Critically Short PMOSs FY 1990-FY 2005 and FY 2001- FY 2005

PMOS	**1990 – 2005**	**PMOS**	**2001 - 2005**
0202	16	0180	5
0602	14	0202	5
7202	10	0602	5
5803	9	6602	5
0402	8	3404	4
4302	8	3002	3
1302	7	1302	2
3404	7	4302	2
7557	7	6002	2
6602	6	7202	2
7543	6	7557	2
0180	5	5803	1
7509	5	7543	1
3002	4	7523	1
6002	4		
7523	4		
7565	2		
1802	1		
1803	1		
4402	1		
7564	1		

(Source: Author, 2006)

Table 24. O-5 Critically Short PMOSs FY 1990-FY 2005 and FY 2001- FY 2005

PMOS	1990 – 2005	PMOS	2001 - 2005
0202	16	0202	5
0602	13	1302	5
4302	13	3404	5
3404	12	4302	5
1302	11	7543	5
6002	11	7557	5
7543	11	0602	4
7557	11	0180	3
0402	8	6002	2
7509	6	7509	2
5803	5	3002	1
0180	4	5803	1
7202	4	7564	1
3002	3		
6602	3		
4402	2		
7564	2		
1803	1		

(Source: Author, 2006)

Table 25. PMOSs that were Never Listed on a Precept as Critically Short

O-4	PMOS	O-5	PMOS
	0302		0302
	0802		0802
	7562		1802
	7563		7523
	7566		7562
			7563
			7565
			7566

(Source: Author, 2006)

E. CHAPTER SUMMARY

This chapter describes the two data files used to analyze retention and promotion patterns of Marine Corps officers: MCCOAC and Marine Officer Cohort data file from DMDC. The dependent variable for the retention models is determined by the number of commissioned months; if the number of months is greater than 119, then the officer survived until 10 YCS. In addition, a preliminary analysis investigated the relationships between PMOSs and occupational fields to determine if they were independent of the

dependent variable ‘stay.’ The null hypothesis that ‘stay’ and PMOS or occupational field are independent is rejected at the 1% significance level.

The dependent variable for both promotion models is determined by a two-step process. First, the officer must survive until the commencement of the O-4 or O-5 promotion board, usually 12 months before the first officer is promoted from a particular year group. The second step used other variables within the data set to determine if the officer accepted promotion to the next rank. If the officer was promoted then the dependent variable PROMO4 or PROMO5 has a value of one, otherwise a zero.

The chi-square test was used to determine if the dependent variable for promotion was independent of an officer’s PMOS or occupational field. The two class groups used in the chi-squared tests are occupational group and PMOS. The null hypothesis is that the dependent variable is independent of PMOS or occupational field. The null hypothesis that promotion and PMOS or occupational field are independent is rejected at the 1% significance level for both promotion models.

A preliminary look at the promotion board precepts revealed that certain PMOSs were consistently below 85% of the GAR requirements. In addition, combat arms PMOSs were rarely listed as critically short. Infantry and artillery PMOSs were never listed as critically short between 1990 and 2005, for either the O-4 or O-5 promotion boards.

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V. MODELS AND RESULTS

> The conduct of war resembles the workings of an intricate machine with tremendous friction, so that combinations which are easily planned on paper can be executed only with effort.
>
> *- Karl von Clausewitz: Principles of War, 1812*

The preliminary results in the previous chapter show that retention and promotion are associated with PMOS or occupational field. The multivariate models specified in this chapter contain additional covariates to help explain the dependent variables. The dummy variables for each PMOS and occupational field included in the retention and promotion models are the design variables of focus. Also included in the models are demographic variables and a performance indicator at TBS. The following sections contain model specifications, hypothesized effects, descriptive statistics and results for each of the three models.

A. 10 YCS RETENTION MODEL

1. Model Specifications for the 10 YCS Retention Model

The model specification used in the 10 YCS retention model to estimate the dichotomous dependent variable, 'stay,' is a binomial logistic regression equation because the predictors are both categorical and continuous, where as the dependent variable is binary. The discrete categorical dependent variable has two possible values: stay until 10 YCS (stay = 1) or leave before 10 YCS (stay = 0). Table 26 summarizes the functions used for the 10 YCS logistic retention models.

Table 26. Specifications for the Logistic Retention Models

1. Stay = ***f*** (Gender, Marital Status, Ethnic Group, Commissioning Age, Commissioning Source, Commissioning Fiscal Year, Prior Enlisted, Third at TBS, PMOS)
2. Stay = ***f*** (Gender, Marital Status, Ethnic Group, Commissioning Age, Commissioning Source, Commissioning Fiscal Year, Prior Enlisted, Third at TBS, Occupational Group)

(Source: Author, 2006)

2. Hypothesized Effects of the Independent Variables for the 10 YCS Retention Model

The independent variables and their hypothesized effects on the dependent variable are shown in Table 27. The overarching assumption is that officers' retention patterns are related to their particular PMOS. This assumption is based on the quality of life associated with each PMOS. Officers who have a better quality of life or more job satisfaction are expected to be more likely to remain beyond 10 YCS. The base case is a single white male who was non-prior service, who was commissioned through PLC, finished in the top third at TBS, held an 0302 (Infantry) PMOS, and was commissioned in FY 1980.

Being a married officer is expected to have a positive effect on the dependent variable because those officers have additional responsibilities compared to single officers. Female officers are expected to be less likely to stay because some might choose to start a family. The expected sign for the ethnicity is unknown because the literature on retention has conflicting arguments as to its effect on the dependent variable. The older an officer is at the time of commissioning, the more likely he or she will stay because such an officer is more mature and has more experience in the work force. Officers who have prior enlisted experience and commissioned through MECEP or ECP, regardless of PMOS, should be more likely to stay because of the amount of time already invested in the armed forces. Officers commissioned through USNA are expected to be more likely to stay because they have invested more time in the Marine Corps since their initial obligation was longer. The expected sign of officers commissioned through OCC is unknown.

The expected sign for officers in the service support occupational field (Adjutant, Finance, Public Affairs and Judge Advocate) is negative because they are presumed to have lower job satisfaction and lower quality of life than officers in the combat arms occupational field. The expected sign for pilots in both communities, fixed wing and rotary wing, should be positive compared to combat arms officers because their initial obligations are longer, and because they receive aviation continuation incentive pay (monthly allowance for being a pilot) and aviation continuation pay (aviation bonus when

they are selected for O-4, occurring around the ten-year mark). The expected sign for officers in the remaining PMOSs is unknown.

Table 27. Hypothesized effects on the Dependent Variable 'Stay'

	Variable	**Expected Sign**
Demographics	Single	Base Case
	Married	+
	Male	Base Case
	Female	-
	White	Base Case
	African American	?
	Hispanic	?
	Other Ethnic Group	?
Commissioning	Commissioning Age (years)	+
	Commissioning FY	?
	PLC	Base Case
	OCC	?
	MECEP	+
	MCP	+
	USNA	+
	NROTC	?
	Prior Enlisted	+
Third at TBS	Top Third	Base Case
	Middle Third	?
	Bottom Third	-
PMOS	0302 (Infantry)	Base Case
	0802 (Artillery)	+
	1802 (Tank)	+
	1803 (AAV)	+
	0180 (Adjutant)	-
	3404 (Finance)	-
	4302 (Public Affairs)	-
	4402 (Judge Advocate)	-
	75XX (All pilots)	+
	All other PMOSs	?
Occupational Fields	Combat Arms	Base Case
	Ground Support	?
	Service Support	-
	Aviation Fixed Wing	+
	Aviation Rotary Wing	+
	Aviation Support	?

(Source: Author, 2006)

3. Descriptive Statistics for the 10 YCS Retention Model

Officers in fiscal years 1994 through 1999 were deleted because the data file was updated on 31 December 2004, therefore ten years have not elapsed. Those officers who were involuntarily separated or had with missing data were deleted from the model, leaving 19,310 officers in the 10 YCS retention sample. The number of observations who survived to 10 YCS was 11,221 (58.11%) and the number of officers who voluntarily left before 10 YCS was 8,089 (41.89%). The numbers of observations, by occupational field, used in the retention sample are shown in Table 28. The descriptive statistics, by occupational group and PMOS, for the 10 YCS Retention Model are shown in Tables 29 through 34.

Table 28. Observations Used in the 10 YCS Retention Sample

	COMBAT	GRDSUP	SERSUP	AVFIXED	AVROTARY	AVSUP	TOTALS
Stay = 0	2,430	2,718	768	756	580	671	8,801
Stay = 1	2,739	3,018	912	1,727	2,062	763	11,441
	5,169	5,736	1,680	2,714	2,642	1,434	19,144

(Source: Author, 2006)

Table 29. Proportions and Sample Means for Combat Arms Occupational Field – 10 YCS Retention Model

Variable	**COMBAT**	**0302**	**0802**	**1802**	**1803**
Stay	0.530	0.576	0.523	0.551	0.556
Prior Enlisted	0.180	0.186	0.168	0.133	0.205
OCC	0.216	0.23	0.211	0.215	0.282
NROTC	0.278	0.268	0.281	0.313	0.261
MECEP	0.030	0.032	0.032	0.018	0.026
ECP	0.033	0.035	0.026	0.018	0.030
USNA	0.106	0.088	0.13	0.115	0.056
Female	0	0	0	0	0
Comm_Age (years)	23.006	23.032	23.014	22.831	23.137
Married	0.275	0.268	0.314	0.313	0.282
African American	0.044	0.046	0.046	0.018	0.034
Hispanic	0.029	0.028	0.035	0.015	0.017
Other Ethnic	0.024	0.021	0.028	0.013	0.068
TBS_Middle Third	0.311	0.299	0.344	0.282	0.325
TBS_Bottom Third	0.291	0.267	0.320	0.262	0.393
TBS Percentile	54.262	56.543	50.616	58.353	44.657

(Source: Author, 2006)

Table 30. Proportions and Sample Means for Ground Support Occupational Field – 10 YCS Retention Model

Variable	GRDSUP	0202	0206	0402	0602
Stay	0.527	0.591	0.549	0.503	0.523
Prior Enlisted	0.241	0.336	0.500	0.260	0.352
OCC	0.257	0.242	0.232	0.277	0.225
NROTC	0.222	0.280	0.207	0.234	0.264
MECEP	0.050	0.099	0.122	0.042	0.097
ECP	0.041	0.069	0.073	0.033	0.054
USNA	0.109	0.113	0.134	0.114	0.110
Female	0.076	0.134	0.076	0.087	0.103
Comm_Age (years)	23.359	23.702	24.000	23.261	23.609
Married	0.352	0.293	0.341	0.293	0.305
African American	0.082	0.022	0.049	0.087	0.105
Hispanic	0.037	0.046	0.037	0.041	0.050
Other Ethnic	0.033	0.043	0.048	0.033	0.038
TBS_Middle Third	0.318	0.296	0.293	0.330	0.310
TBS_Bottom Third	0.408	0.269	0.293	0.450	0.404
TBS Percentile	44.513	56.421	57.796	41.311	45.462

Variable	1302	3002	5803
Stay	0.532	0.435	0.592
Prior Enlisted	0.191	0.178	0.461
OCC	0.244	0.286	0.296
NROTC	0.298	0.203	0.107
MECEP	0.021	0.016	0.121
ECP	0.013	0.034	0.126
USNA	0.124	0.150	0.029
Female	0.013	0.088	0.102
Comm_Age (years)	23.100	23.210	24.432
Married	0.286	0.369	0.456
African American	0.039	0.127	0.087
Hispanic	0.031	0.033	0.024
Other Ethnic	0.042	0.035	0.034
TBS_Middle Third	0.335	0.326	0.354
TBS_Bottom Third	0.299	0.516	0.330
TBS Percentile	52.579	35.301	49.729

(Source: Author, 2006)

Table 31. Proportions and Sample Means for Service Support Occupational Field – 10 YCS Retention Model

Variable	**SERSUP**	**0180**	**3404**	**4302**	**4402**
Stay	0.543	0.517	0.499	0.524	0.489
Prior Enlisted	0.225	0.390	0.285	0.427	0.100
OCC	0.255	0.369	0.256	0.329	0.191
NROTC	0.156	0.189	0.237	0.134	0.034
MECEP	0.045	0.081	0.072	0.146	0.004
ECP	0.039	0.078	0.067	0.098	0
USNA	0.071	0.087	0.109	0.085	0.016
Female	0.171	0.414	0.173	0.317	0.066
Comm_Age (years)	23.798	24.075	23.527	24.146	23.970
Married	0.384	0.414	0.363	0.415	0.408
African American	0.075	0.103	0.115	0.073	0.055
Hispanic	0.042	0.042	0.037	0.049	0.043
Other Ethnic	0.035	0.030	0.043	0	0.034
TBS_Middle Third	0.325	0.279	0.323	0.378	0.338
TBS_Bottom Third	0.388	0.562	0.453	0.390	0.298
TBS Percentile	46.174	34.637	41.616	42.770	52.357

(Source: Author, 2006)

Table 32. Proportions and Sample Means for Aviation Fixed Wing Occupation Field – 10 YCS Retention Model

Variable	**AVFIXED**	**7509**	**7523**	**7543**	**7557**
Stay	0.679	0.689	0.781	0.500	0.467
Prior Enlisted	0.113	0.164	0.250	0.104	0.133
OCC	0.176	0.344	0.391	0.292	0.533
NROTC	0.151	0.262	0.266	0.104	0.100
MECEP	0.010	0	0	0.042	0
ECP	0.013	0.016	0.016	0.021	0.067
USNA	0.147	0.148	0	0.104	0.067
Female	0.003	0	0	0	0
Comm_Age (years)	22.870	23.377	23.359	22.604	23.233
Married	0.338	0.328	0.266	0.583	0.567
African American	0.016	0	0.016	0	0.033
Hispanic	0.021	0.016	0.016	0	0.033
Other Ethnic	0.014	0	0.016	0	0.067
TBS_Middle Third	0.344	0.230	0.313	0.354	0.333
TBS_Bottom Third	0.199	0.066	0.156	0.354	0.433
TBS Percentile	59.997	74.066	64.406	47.742	44.894

(Source: Author, 2006)

Table 33. Proportions and Sample Means for Aviation Rotary Wing Occupational Field – 10 YCS Retention Model

Variable	ROTARY	7562	7563	7564	7565	7566
Stay	0.777	0.757	0.756	0.635	0.813	0.780
Prior Enlisted	0.128	0.110	0.209	0.069	0.122	0.200
OCC	0.186	0.303	0.326	0.308	0.309	0.390
NROTC	0.163	0.186	0.186	0.151	0.209	0.210
MECEP	0.012	0.016	0.023	0.006	0.014	0.030
ECP	0.013	0.016	0.070	0.025	0.022	0.040
USNA	0.125	0.136	0.081	0.082	0.065	0.080
Female	0.005	0.006	0.012	0.013	0.007	0.020
Comm_Age (years)	22.986	23.057	23.581	22.931	23.029	23.22
Married	0.323	0.498	0.547	0.560	0.381	0.460
African American	0.027	0.022	0	0.038	0.029	0.020
Hispanic	0.035	0.013	0.023	0.006	0.022	0.020
Other Ethnic	0.030	0.016	0.023	0.006	0.043	0.020
TBS_Middle Third	0.359	0.375	0.337	0.277	0.353	0.370
TBS_Bottom Third	0.312	0.344	0.244	0.522	0.273	0.300
TBS Percentile	50.523	46.725	55.499	35.785	54.188	50.419

(Source: Author, 2006)

Table 34. Proportions and Sample Means for Aviation Support Occupational Field – 10 YCS Retention Model

Variable	AVSUP	6002	6602	7202
Stay	0.532	0.585	0.446	0.464
Prior Enlisted	0.257	0.357	0.274	0.045
OCC	0.245	0.246	0.255	0.173
NROTC	0.196	0.180	0.191	0.173
MECEP	0.062	0.114	0.051	0.027
ECP	0.063	0.114	0.032	0.018
USNA	0.117	0.092	0.261	0.082
Female	0.069	0.099	0.096	0.045
Comm_Age (years)	23.635	0.114	23.478	23.018
Married	0.368	24.195	0.293	0.382
African American	0.056	0.401	0.089	0.055
Hispanic	0.039	0.048	0.051	0.045
Other Ethnic	0.030	0.022	0.045	0.018
TBS_Middle Third	0.327	0.338	0.325	0.364
TBS_Bottom Third	0.375	0.283	0.478	0.355
TBS Percentile	47.050	53.649	40.392	46.026

(Source: Author, 2006)

4. Logistic Regression Estimates for the 10 YCS Retention Model

The classification table results shown in Table 35, predict the accuracy of the logistic regression model where the observed values for the dependent outcome and the predicted values are cross classified at a cut off value where p = 0.72. The retention model correctly predicts 51% of the retention decisions. The R-Square value is 0.0767; although very low, it is not unusual for a logistic regression model. The Likelihood Ratio, Score, and Wald statistics which test the global null hypothesis that all Betas = 0, are significant at the 1% level. Therefore, at least one Beta is not equal to zero and the global null hypothesis is rejected.

A list of variables used in the logistic regression retention models and their coefficients, standard errors, chi-squared values, partial effects, and odds ratios are shown in Tables 36 and 37. The logistic Retention Model shows that thirty out of thirty-two PMOSs were significant in determining whether an officer stays until 10 YCS, when compared to the base case (infantry officer).

Table 35. Classification Table for the 10 YCS Retention Model

Observed		Predicted		Percentage Correct
		Stay = 0	Stay = 1	
Stay = 0	8,088	7,437	651	91.9
Stay = 1	11,221	8,814	2,407	21.5
Prob. Level	.72			
Overall Percentage				51.0

(Source: Author, 2006)

Table 36. Logistic Estimates for the 10 YCS Retention Model

Variable	Coefficient	Standard Error	Chi-Square	Partial Effect	Odds Ratio
Intercept	-1.993	0.230	75.241	0.000	
Married	0.462 ***	0.036	167.745	0.113	1.587
Comm_Age (years)	0.0782***	0.010	61.681	0.020	1.081
Female	-0.0035	0.079	0.002	-0.001	0.997
African American	-0.00007	0.070	0	-0.00002	1.000
Hispanic	-0.051	0.085	0.360	-0.013	0.950
Other Ethnic Group	0.041	0.093	0.190	0.010	1.041

Variable	Coefficient	Standard Error	Chi-Square	Partial Effect	Odds Ratio
TBS Percentile	0.004 ***	0.001	51.319	0.001	1.004
Prior Enlisted	0.032	0.053	0.377	0.008	0.893
NROTC	-0.114 ***	0.042	7.173	-0.028	0.984
USNA	-0.016	0.052	0.094	-0.004	0.984
OCC	-0.266 ***	0.045	34.992	-0.066	0.767
MECEP	0.605 ***	0.121	25.208	0.146	1.831
ECP	0.353 ***	0.111	10.131	0.087	1.423
Adjutant	-0.564 ***	0.123	21.089	-0.138	0.569
Intelligence	-0.435 ***	0.113	14.776	-0.107	0.647
Signals Intelligence	-0.479 ***	0.169	8.073	-0.118	0.619
Logistics	-0.578 ***	0.059	97.737	-0.141	0.561
Communications	-0.488 ***	0.067	53.458	-0.120	0.614
Artillery	-0.482 ***	0.057	70.642	-0.119	0.618
Engineer	-0.446 ***	0.086	26.676	-0.110	0.640
Tank	-0.340 ***	0.108	9.961	-0.084	0.712
AAV	-0.273 **	0.127	3.944	-0.068	0.761
Supply	-0.817 ***	0.072	125.898	-0.191	0.449
Finance	-0.657 ***	0.111	34.911	-0.159	0.518
Public Affairs	-0.601 **	0.236	6.485	-0.147	0.548
Judge Advocate	-0.786 ***	0.084	86.652	-0.188	0.456
MP	-0.445 ***	0.152	8.540	-0.110	0.641
Aircraft Maintenance	-0.447 ***	0.132	11.513	-0.110	0.640
Air Command / Control	-0.652 ***	0.133	25.368	-0.158	0.521
Aviation Supply	-0.669 ***	0.144	4.987	-0.162	0.725
LAAD	-0.322 **	0.136	17.373	-0.080	0.567
Air Support Control	-0.568 ***	0.151	17.099	-0.139	0.536
Air Defense Control	-0.623 ***	0.202	12.813	-0.151	0.485
Air Traffic Control	-0.724 ***	0.284	0.620	-0.174	1.250
AV8B	0.224	0.310	6.057	0.056	2.144
FA18	0.763 **	0.300	4.947	0.181	0.514
EA6B	-0.666 **	0.219	20.080	-0.161	0.374
C130	-0.983 ***	0.137	26.069	-0.230	2.013
CH46	0.700 ***	0.259	3.776	0.167	1.652
UH1	0.502 *	0.172	0.453	0.123	1.123
CH53A_D	0.116	0.223	18.080	0.029	2.578
AH1	0.947 ***	0.249	7.065	0.220	1.937
CH53E	0.661 ***	0.449	7.377	0.159	3.383
A6E	1.219 ***	0.204	8.015	0.270	1.782
EA6B Electronic	0.578 ***	0.078	89.250	0.140	2.088
FY 81	0.736 ***	0.071	17.254	0.175	1.345
FY 82	0.296 ***	0.065	15.085	0.073	1.285
FY 83	0.251 ***	0.065	15.085	0.062	1.285
FY 84	0.388 ***	0.069	31.983	0.096	1.474

Variable	Coefficient	Standard Error	Chi-Square	Partial Effect	Odds Ratio
FY 85	0.494 ***	0.071	48.421	0.121	1.639
FY 86	0.670 ***	0.073	83.946	0.161	1.954
FY 87	0.4537 ***	0.068	43.981	0.111	1.573
FY 88	0.583 ***	0.072	66.424	0.141	1.791
FY 89	0.824 ***	0.071	133.277	0.194	2.280
FY 90	0.853 ***	0.076	124.504	0.200	2.347
FY 91	0.928 ***	0.074	156.633	0.216	2.530
FY 92	0.737 ***	0.072	104.960	0.176	2.089
FY 93	0.916 ***	0.075	150.463	0.213	2.498

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

The partial effect value describes the percentage change in the predicted probability for a base case officer with average values for continuous variables and binary variables equal to zero. The partial effect estimate which explains whether an officer is more or less likely to stay until 10 YCS than the base case, depending on the sign, is used to compare officers in different PMOSs or occupational fields to an average base case officer. (Here a positive sign means more likely, and a negative sign means less likely, than the base case to stay until 10 YCS.) The base case is a single white male who was non-prior service, who was commissioned through PLC, finished in the top third at TBS, held an 0302 (Infantry) PMOS, and was commissioned in FY 1980.

In the 10 YCS Retention Model all PMOSs within the combat arms, ground support, and service support occupational fields have a negative and significant effect on retention when compared to the base case. The Artillery PMOS has a negative coefficient, different from what was hypothesized, and the coefficient is significant at the 1% level. According to the model, an artillery officer who has all the other base-case attributes is 11.9% less likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of any artillery officer staying until 10 YCS are 0.614 times (that is, 38.6% less than) the odds of an infantry officer with otherwise identical attributes. The Communications PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, a communications officer who has all the other base-case attributes is 12.0% less likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of any communications officer staying until 10 YCS are 0.561 times (that is, 43.9% less than)

the odds of an infantry officer with otherwise identical attributes. The Judge Advocate PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, a judge advocate officer who has all the other base-case attributes is 18.8% less likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of any judge advocate officer staying until 10 YCS are 0.548 times (that is, 45.2% less than) the odds of an infantry officer with otherwise identical attributes. The Intelligence PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an intelligence officer who has all the other base-case attributes is 10.74% less likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of any intelligence officer staying until 10 YCS are 0.569 times (that is, 43.1% less than) the odds of an infantry officer with otherwise identical attributes.

A CH46 PMOS has a positive coefficient and the coefficient is significant at the 1% level. According to the model, a CH46 pilot who has all the other base-case attributes is 16.7% more likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of any CH46 pilot staying until 10 YCS are 1.652 times (that is, 65.2% greater than) the odds of an infantry officer with otherwise identical attributes.

According to the model an officer commissioned through MECEP or ECP who has all the other base-case attributes is 14.6% or 8.7% respectively more likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of an officer commissioned through MECEP staying until 10 YCS are 1.831 times (that is, 83.1% greater than) the odds of an officer commissioned through PLC with otherwise identical attributes. The odds of an officer commissioned through ECP staying until 10 YCS are 1.423 times (that is, 42.3% greater than) the odds of an officer commissioned through PLC with otherwise identical attributes.

The coefficient for an officer's TBS class standing percentile is positive and significant at the 1% level; therefore TBS standing is positively correlated with retention. The odds ratio of 1.004 for TBS class standing percentile says that under the model, each one-percentile increase in class standing is associated with a 0.4% increase in the

predicted odds of staying. The coefficient for commissioning age is positive and significant at the 1% level, therefore it positively affects retention. The odds ratio of 1.081 for commissioning age says that under the model, each one-year increase in age is associated with an 8.1% increase in the predicted odds of staying.

Table 37. Logistic Estimates for the 10 YCS Retention Model with OccFld's

Variable	Coefficient	Standard Error	Chi-Square	Partial Effect	Odds Ratio
Intercept	-2.115	0.228	86.000	-0.000	
Married	0.441 ***	0.036	154.467	0.109	1.666
Comm_Age	0.079 ***	0.010	62.941	0.020	1.103
Female	0.009	0.077	0.014	0.002	1.174
African American	-0.015	0.069	0.044	-0.004	1.129
Hispanic	-0.057	0.085	0.446	-0.014	1.116
Other Ethnic Group	0.031	0.092	0.112	0.008	1.236
TBS Percentile	0.005 ***	0.0005	69.826	0.001	1.006
Prior Enlisted	0.035	0.052	0.432	0.009	1.035
NROTC	-0.133 ***	0.042	10.157	-0.033	0.875
USNA	-0.030	0.052	0.331	-0.008	0.971
OCC	-0.281 ***	0.044	39.931	-0.070	0.755
MECEP	0.621 ***	0.120	26.953	0.152	1.861
ECP	0.367 ***	0.110	11.121	0.091	1.443
Ground Support	-0.432 ***	0.037	137.926	-0.106	0.649
Service Support	-0.495 ***	0.057	76.032	-0.120	0.610
Aviation Fixed	0.204 ***	0.076	7.161	0.051	1.226
Aviation Rotary	0.724 ***	0.076	68.253	0.175	2.062
Aviation Support	-0.414 ***	0.060	48.294	-0.104	0.661
FY 81	0.648 ***	0.077	70.616	0.158	1.911
FY 82	0.224 ***	0.071	10.062	0.056	1.251
FY 83	0.211 ***	0.064	10.851	0.053	1.235
FY 84	0.356 ***	0.676	27.670	0.088	1.427
FY 85	0.471 ***	0.070	44.782	0.116	1.602
FY 86	0.660 ***	0.073	82.377	0.161	1.935
FY 87	0.449 ***	0.068	43.839	0.111	1.567
FY 88	0.553 ***	0.071	67.368	0.143	1.792
FY 89	0.835 ***	0.071	138.678	0.200	2.305
FY 90	0.851 ***	0.076	125.545	0.203	2.342
FY 91	0.936 ***	0.072	160.773	0.221	2.550
FY 92	0.731 ***	0.072	104.110	0.177	2.076
FY 93	0.927 ***	0.074	155.610	0.219	2.528

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

Table 37 shows that each of the occupational fields had a significant effect on retention at the 1% level, when compared to the combat arms occupational field. A ground support occupational field has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an officer in the ground support occupational field that has all the other base-case attributes is 10.6% less likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of any officer in the ground support occupational field staying until 10 YCS are 0.649 times (that is, 35.1% less than) the odds of an officer in the combat arms occupational field with otherwise identical attributes. The aviation rotary wing occupational field has a positive coefficient and the coefficient is significant at the 1% level. According to the model, an officer in the aviation rotary wing occupational field who has all the other base-case attributes is 17.6% more likely to stay until 10 YCS than an officer whose attributes are entirely those of the base case. The odds of any officer in the aviation rotary wing occupational field staying until 10 YCS are 2.062 times (that is, 100.06% more than) the odds of an officer in the combat arms occupational field with otherwise identical attributes.

5. PROC LIFETEST Results for the 10 YCS Retention Model

The LIFETEST procedure in SAS uses two methods to estimate survivor functions: Kaplan-Meier and Life-table. The Kaplan-Meier method was used to test whether the survival functions were identical for different PMOS or occupational fields. The LIFETEST procedure examined 16,323 officers of which 11,371 observations were censored. Table 38 gives the quartile point estimates, where the probability of leaving the Marine Corps being greater than .75 occurs at 228 months of commissioned service. The point estimate for the 50% quartile is 179 months and the 95% confidence interval gives lower and upper ranges of 175 and 180 respectively. The mean given by the procedure is 186.423 months with a standard error of 0.459, but the "median is usually a much preferred measure of central tendency for censored survival data."[46]

[46] Paul D. Allison, Survival Analysis Using SAS (SAS Publishing, North Carolina, 2003), p.33.

Table 38. PROC LIFETEST Procedure with Kaplan-Meier Summary Statistics – 10 YCS Retention Model

		95% Confidence Interval	
%	Point Estimate	Lower	Upper
75	228	225	230
50	179	175	180
25	144	142	144

(Source: Author, 2006)

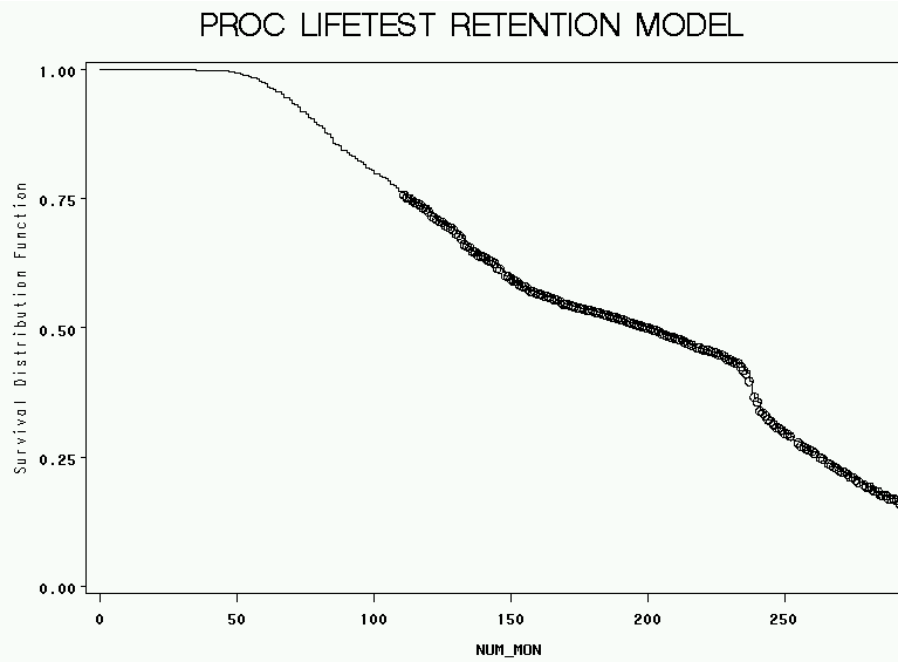
The LIFETEST procedure produces a graph that depicts the estimated survival function. Figure 11 shows the estimated survival function for Marine Corps officers commissioned between 1980 and 1993. The estimated survival function has a downward slope, except during the first 50 months of commissioned service because an officer must complete his or her obligated service. Historically, attrition rates have been lowest during the initial obligation period. The graph depicts a subtle decrease in the magnitude of the slope of the estimated survival function at 150 months of commissioned service, mainly due to selection to O-4.

The LIFETEST procedure produces graphs that compare two different groups in order to determine if they have identical survival functions. This procedure was used to evaluate different PMOSs and occupational fields and the results illustrate which PMOSs or occupational fields have different survival functions. For example, Figure 12 illustrates the different survival functions for the six occupational fields, where each occupational field has a separate survival function depicted by one of six different colors. Figure 12 shows that officers in the service support occupational field survive to 10 YCS at the lowest rate and rotary wing pilots at the highest rate.

The LIFETEST procedure uses the log-rank and Wilcoxon tests, to determine if groups have identical survival functions. The source variable (either PMOS or occupational field) were tested to determine if the estimated survival functions are identical. The LIFETEST procedure gives the rank statistics and covariance for the Log-rank and Wilcoxon tests for each PMOS or occupational field. The results of the rank statistics and covariance are used to compute the Chi-Square statistic.[47]

[47] Paul D. Allison, Survival Analysis Using SAS (SAS Publishing, North Carolina, 2003), p.33.

Figure 11. Graph of the Survival Distribution Function - 10 YCS Retention Model

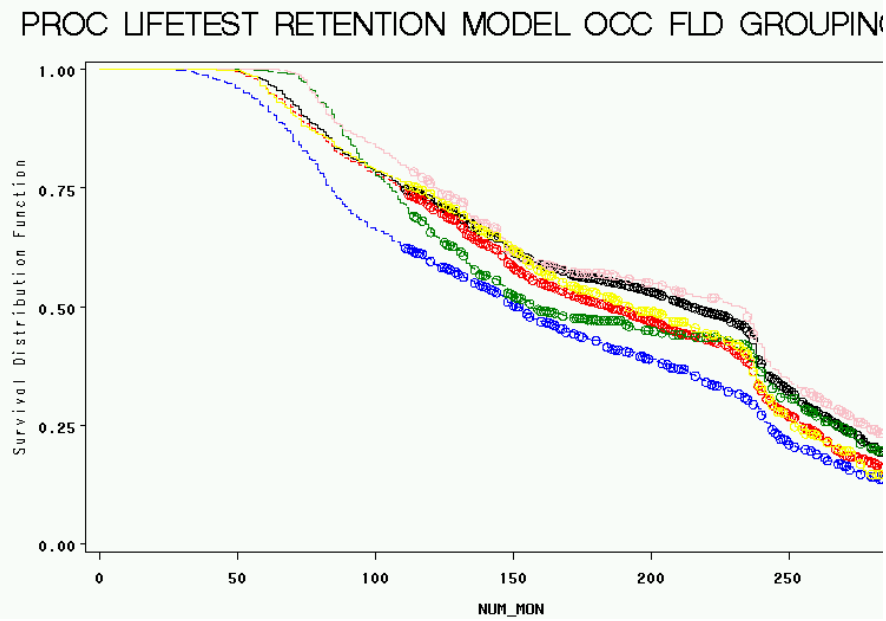


Num_Mon is the number of months from commissioning

(Source: Author, 2006)

Table 39 presents the summary of the number of censored and uncensored values and the rank statistics for the six occupational groups. Table 40 shows that the Test of Equality over Strata and the results of the Log-rank and Wilcoxon test are significant for occupational groupings (the p-values for both tests, given in the Pr > chi-square column, are <.0001). The null hypothesis that there is no difference in survival functions among the different occupational fields is rejected. Therefore, the survival functions of groups of officers within different occupational fields are not identical. Table 41 shows that the Test of Equality over Strata and the results of the Log-rank and Wilcoxon test are significant for PMOSs (the p-values for both tests, given in the Pr > chi-square column, are <.0001). The null hypothesis that there is no difference in survival functions among the different PMOSs is rejected and their survival functions are therefore not identical.

Figure 12. Graph of PROC LIFETEST with Occupational Field – 10 YCS Retention Model



Occupational Field 1 – Combat Arms: black
Occupational Field 2 – Ground Support: red
Occupational Field 3 – Service Support: blue
Occupational Field 4 – Aviation Fixed Wing: green
Occupational Field 5 – Aviation Rotary Wing: pink
Occupational Field 6 – Aviation Support: yellow

(Source: Author, 2006)

Table 39. Summary of Censored and Uncensored Values with Test Statistics

Source	Total	Failed	Censored	Percent Censored	Log-Rank	Wilcoxon
Combat Arms	4,321	1,291	3,030	70.12	-104.65	-1059576
Ground Support	3,876	1,244	2,632	67.91	7.38	111107
Service Support	1,284	554	730	56.85	187.63	2126919
Aviation Fixed	1,027	365	662	64.46	27.31	95589
Aviation Rotary	951	242	709	74.55	-82.43	-955239
Aviation Support	1,082	313	769	71.07	-35.24	-318800

(Source: Author, 2006)

Table 40. Testing Homogeneity of Survival Curves for Different Occupational Fields – 10 YCS Retention Model

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	131.784	5	<.0001
Wilcoxon	144.053	5	<.0001
-2Log (LR)	133.455	5	<.0001

(Source: Author, 2006)

Table 41. Testing Homogeneity of Survival Curves for Different PMOSs – 10 YCS Retention Model

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	1388.017	49	<.0001
Wilcoxon	999.213	49	<.0001
-2Log (LR)	122.595	49	<.0001

(Source: Author, 2006)

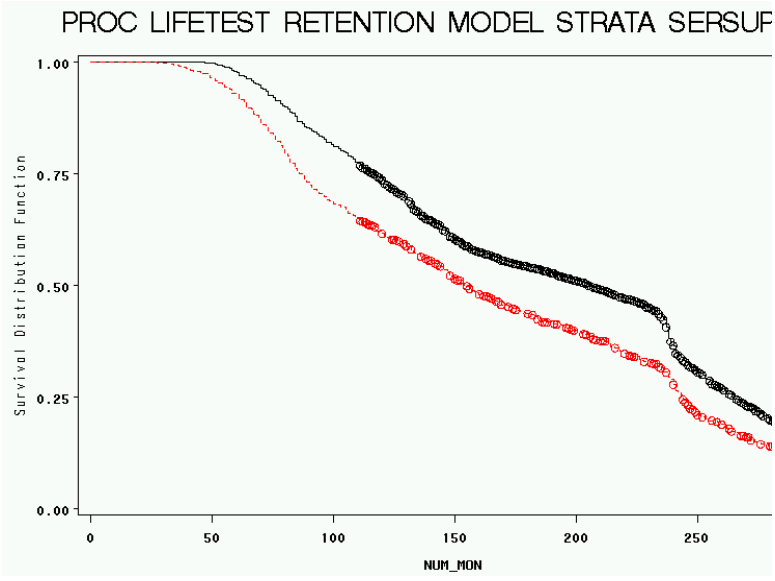
Appendix A shows LIFETEST graphs for each occupational field and selected PMOSs within each of the six occupational field groupings. Table 42 shows the test results for homogeneity for the service support occupational field and Figure 13 displays the survival function for service support officers. Table 43 shows the test results for homogeneity for artillery officers and Figure 14 displays the survival function for artillery officers. In both cases the null hypothesis is rejected, therefore they have different survival patterns.

Table 42. Testing Homogeneity of Survival Curves for Service Support Officers – 10 YCS Retention Model

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	124.395	1	<.0001
Wilcoxon	143.552	1	<.0001
-2Log (LR)	93.137	1	<.0001

(Source: Author, 2006)

Figure 13. Graph of PROC LIFETEST for Service Support Occupational Field – 10 YCS Retention Model



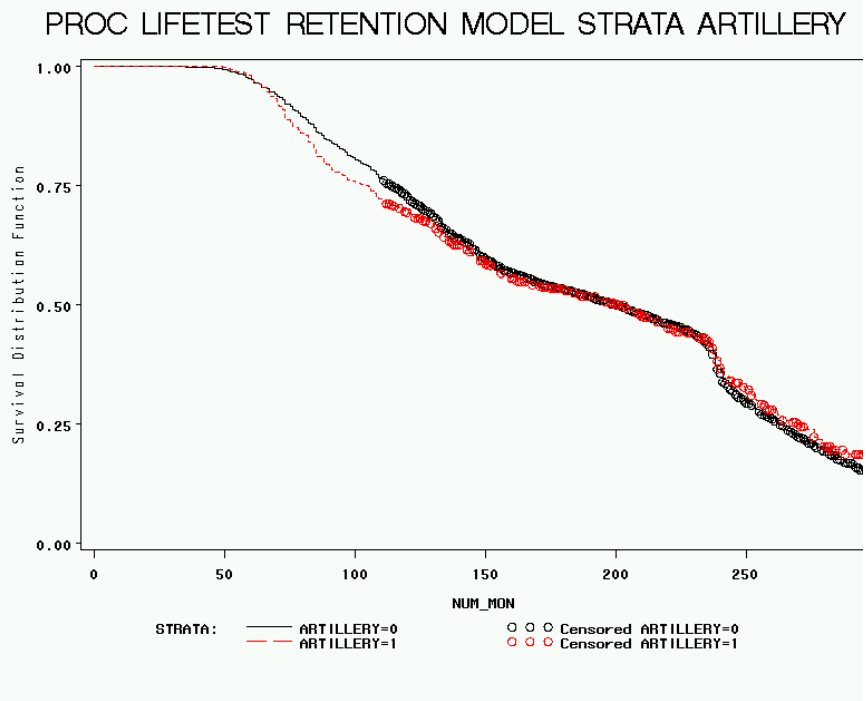
Service Support = 0 (Black) Service Support = 1 (Red)
(Source: Author, 2006)

Table 43. Testing Homogeneity of Survival Curves for Artillery Officers – 10 YCS Retention Model

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	7.165	1	0.007
Wilcoxon	8.977	1	0.003
-2Log (LR)	3.302	1	0.069

(Source: Author, 2006)

Figure 14. Graph of PROC LIFETEST for Artillery Officers - 10 YCS Retention Model



Artillery = 0 (Black) Artillery = 1 (Red)

(Source: Author, 2006)

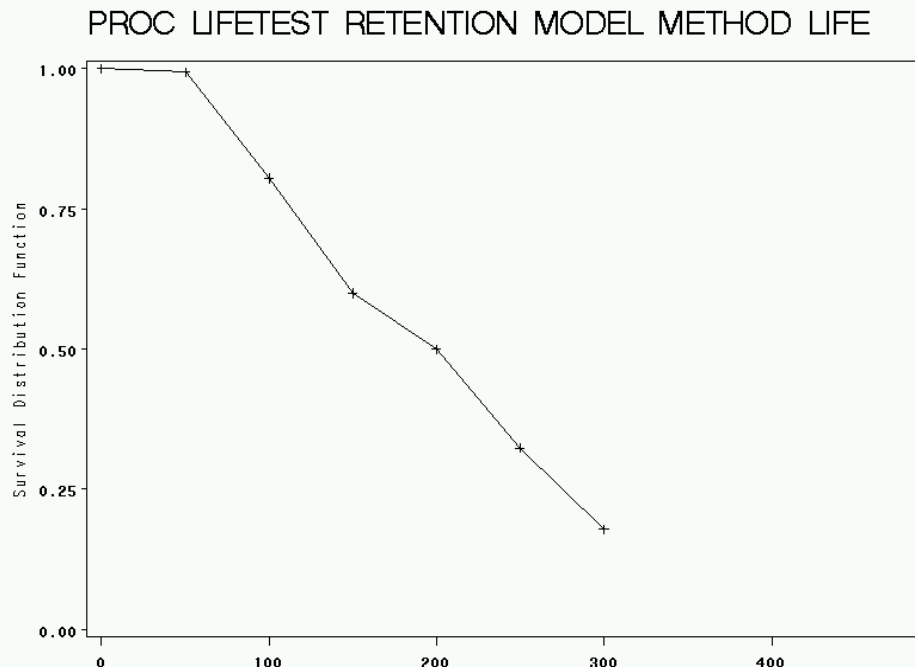
The hazard function "shows an instantaneous failure rate or the probability that an individual having not failed up until time *t* will fail during the infinitesimally small intervals $t + \Delta$."[48] The hazard function illustrates the major decision points for officers that occur at ten and sixteen years of commissioned service. The hazard function rises and peaks around 120 months (promotion point to O-4) then declines until around 192 months (promotion point to O-5). The hazard rate rises until 280 months because officers reach retirement eligibility at 240 months. Figure 15 shows the survival distribution

[48] Carl Mason, Hazard / Survival Models: Simple Examples, 2005, p.2.

function estimates and Figure 16 shows the hazard function for Marine Corps officers during fiscal years 1980 through 1993.

"LIFETEST is a useful procedure for preliminary analysis of survival data and for testing simple hypotheses about differences in survival across groups. But the procedure is not adequate for two factor designs because there is no way to test for interactions and it is not adequate for examining the effects of variables controlling for other covariates."[49] In order to estimate the model further, PROC PHREG which performs Cox Proportional Hazard Analysis, was used to analyze interactions and the effects of other covariates on the dependent variable.

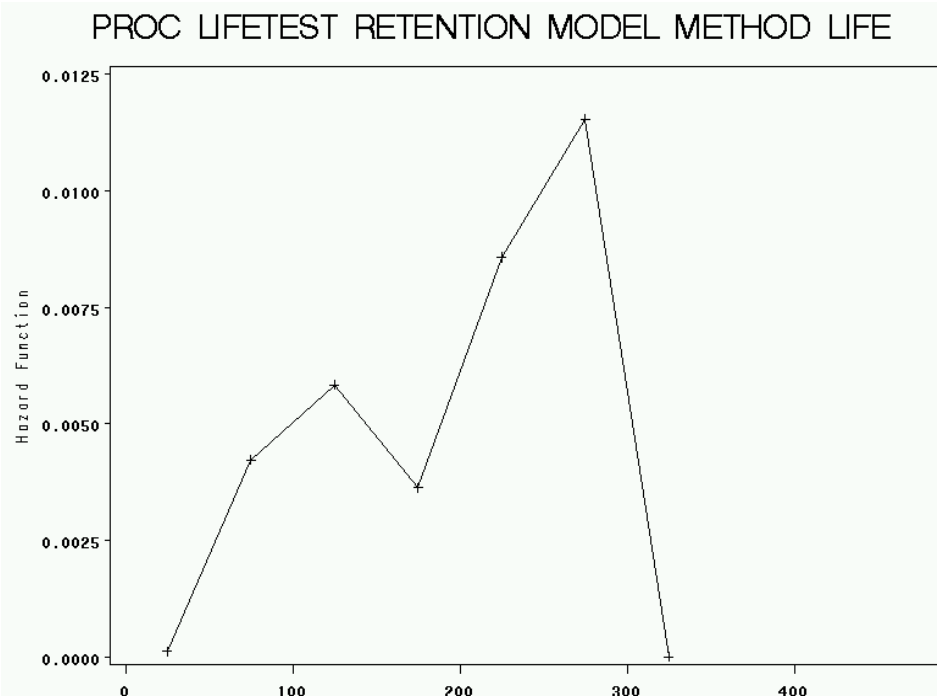
Figure 15. Life-Table Survival Distribution Function Estimates – 10 YCS Retention Model



(Source: Author, 2006)

[49] Paul D. Allison, Survival Analysis Using SAS (SAS Publishing, North Carolina, 2003), p.113.

Figure 16. Hazard Function Estimates for the 10 YCS Retention Model



(Source: Author, 2006)

6. Cox Regression Estimates for the 10 YCS Retention Model

The PHREG procedure in SAS uses a semi-parametric regression model which does not require the choice of a particular probability distribution to represent survival times. It is considered more robust than LIFEREG for this reason. In addition, Cox regression allows for both discrete and continuous measurements of event times. The main reason that Cox regression is preferred over other survival functions is that the "hazard for any individual is a fixed proportion of the hazard for any other individual and the parameters of the proportional hazards model can be estimated without having to specify the baseline hazard function h0(*t*). The estimation of the coefficients is done by using the partial likelihood principle." [50]

The Cox regression model combines the Proportional Hazards Model with the partial likelihood method. "The equation states that the hazard for an individual *i* at time *t* is the product of two factors: a baseline hazard function $\lambda_0(t)$ that is left unspecified,

[50] Paul D. Allison, Survival Analysis Using SAS (SAS Publishing, North Carolina, 2003), p.114.

except that it can be negative and a linear function of a set of *k* covariates, which is then exponentiated."[51]

"The basic model is:

$$h_i(t)=\lambda_0(t)\exp\{\beta_1 x_{i1}+\ldots+\beta_k x_{ik}\}$$

where the hazard function $\lambda_0(t)$ for an individual whose covariates all have values of 0 and *k* is the number of fixed covariates. By taking the logarithm of both sides, the model can be written as:

$$\text{Log}h_i(t)=\alpha(t)+\beta_1 x_{i1}+\ldots+\beta_k x_{ik}$$ where $\alpha(t)=\log \lambda_0(t)$."[52]

The logarithms of the hazard ratio attributed to the covariate are used to estimate coefficients and the exponential of the coefficient is the hazard ratio. The estimated percent change in the hazard given a one unit increase in the covariate results in the hazard ratio. If the hazard ratio is greater than one then there is an increase in the hazard and if the hazard ratio is less than one then there is a decrease in the hazard.

The number of observations used in the PHREG procedure was 19,309 where 8,088 values were censored. Table 44 shows the results of the global null hypothesis: Beta = 0 when PMOSs are included in the model. The results of each test are significant and the null hypothesis is rejected. Table 45 shows the parameter estimates, standard errors, chi-squared values and hazard ratios for the variables used in the Cox regression model.

The significant variables in the Cox regression model include: married, commissioning age, Hispanic, other ethnic groups, TBS percentile, prior enlisted, USNA, OCC, MECEP, ECP and each fiscal year except 1985. The significant focus variables include: artillery, engineer, tank, supply, judge advocate, CH46, CH53 A_D, and A6E.

Subtracting 1.0 from the risk ratio and multiplying the result by 100 yields a more useful statistic for quantitative covariates which gives the estimated percent change in the hazard for each one unit increase in the covariate.[53] The estimated risk for being married

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[51] Paul D. Allison, Survival Analysis Using SAS (SAS Publishing, North Carolina, 2003), p.114..

[52] Ibid, p.113.

[53] Ibid, p.117.

is 82.2% of the hazard for those who are single (controlling for other covariates). Therefore, the hazard of leaving before 10 YCS for married officers goes down by an estimated 17.8%. The estimated risk for being Hispanic is 123.7% of the hazard for those who are white (controlling for other covariates). Therefore, the hazard of leaving before 10 YCS for Hispanic officers goes up by an estimated 23.7%. The estimated risk for artillery officers is 91.3% of the hazard for those who are infantry officers (controlling for other covariates). Therefore, the hazard of leaving before 10 YCS for artillery officers goes down by an estimated 8.7%.

Table 44. Test Results for the Global Null Hypothesis: PROC PHREG by PMOS – 10 YCS Retention Model

Test	Chi-Square	DF	Pr > Chi-Square
Likelihood Ratio	5022.173	58	<.0001
Score	5893.941	58	<.0001
Wald	4929.346	58	<.0001

(Source: Author, 2006)

Table 45. Analysis of Maximum Likelihood Estimates for PROC PHREG by PMOS – 10 YCS Retention Model

Variable	**Parameter Estimate**	**Standard Error**	**Chi-Square**	**Hazard Ratio**
Married	-0.197***	0.022	80.849	0.822
Comm_Age	0.030 ***	0.006	26.400	1.031
Female	-0.002	0.056	0.001	0.998
African American	0.007	0.046	0.022	1.007
Hispanic	0.213 ***	0.054	15.286	1.237
Other Ethnic Group	0.096 *	0.058	2.743	1.100
TBS Percentile	-0.0007 **	0.0003	4.326	0.999
Prior Enlisted	0.266 ***	0.034	61.701	1.305
NROTC	0.027	0.027	1.013	1.027
USNA	0.064 *	0.033	3.670	1.066
OCC	-0.093 ***	0.028	10.783	0.911
MECEP	0.258 ***	0.057	20.241	1.295
ECP	-0.159 ***	0.060	6.914	0.853
Adjutant	-0.061	0.082	0.557	0.940
Intelligence	-0.040	0.070	0.322	0.961
Signals Intelligence	-0.164	0.106	2.393	0.849
Logistics	-0.038	0.039	0.918	0.963
Communications	0.004	0.043	0.007	1.004
Artillery	-0.091 **	0.038	5.751	0.913
Engineer	-0.114 **	0.057	3.976	0.892
Tank	-0.205 ***	0.070	8.568	0.815

Variable	Parameter Estimate	Standard Error	Chi-Square	Hazard Ratio
AAV	-0.120	0.089	1.804	0.887
Supply	-0.132 ***	0.051	6.682	0.876
Finance	0.015	0.076	0.040	1.015
Public Affairs	0.182	0.155	1.395	1.200
Judge Advocate	-0.127 **	0.058	4.832	0.881
MP	-0.010	0.092	0.011	0.990
Aircraft Maintenance	-0.002	0.081	0.001	0.998
Air Command / Control	-0.035	0.142	0.062	0.997
Aviation Supply	-0.0005	0.091	0.0000	0.999
LAAD	-0.006	0.091	0.004	0.994
Air Support Control	-0.064	0.093	0.462	0.938
Air Defense Control	-0.109	0.101	1.155	0.897
Air Traffic Control	-0.162	0.138	1.381	0.851
AV8B	-0.093	0.156	0.356	0.911
FA18	0.074	0.143	0.269	1.077
EA6B	-0.034	0.206	0.028	0.966
C130	0.207	0.162	1.635	1.229
CH46	-0.330 ***	0.068	23.825	0.719
UH1	-0.145	0.125	1.338	0.865
CH53A_D	-0.321 ***	0.102	9.912	0.726
AH1	-0.051	0.096	0.280	0.951
CH53E	0.008	0.115	0.005	1.008
A6E	-0.385 **	0.173	4.963	0.680
EA6B Electronic	-0.076	0.095	0.634	0.927
FY 81	-0.625 ***	0.047	178.091	0.535
FY 82	-0.582 ***	0.048	145.173	0.559
FY 83	-0.457 ***	0.046	97.390	0.633
FY 84	-0.246 ***	0.050	24.405	0.782
FY 85	0.022	0.051	0.187	1.022
FY 86	0.198 ***	0.017	14.595	1.218
FY 87	0.409 ***	0.518	62.296	1.506
FY 88	0.609 ***	0.053	129.851	1.839
FY 89	0.842 ***	0.052	261.196	2.320
FY 90	1.074 ***	0.055	377.612	2.926
FY 91	1.363 ***	0.054	628.273	3.910
FY 92	1.433 ***	0.054	704.304	4.192
FY 93	2.219 ***	0.057	1508.381	9.199

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

Table 46 shows the results of the global null hypothesis: Beta = 0 when occupational groups are included in the model. The results of the Likelihood Ratio, Score, and Wald test are significant and the null hypothesis is rejected.

Table 47 shows the parameter estimates, standard errors, chi-squared values and hazard ratios for the variables used in the Cox regression model when the focus variables are the occupational fields. The significant variables in the Cox regression model include: married, commissioning age, Hispanic, other ethnic groups, TBS percentile, prior enlisted, USNA, OCC, MECEP, ECP and each fiscal year except 1985.

The significant focus variables include aviation fixed wing and aviation rotary wing. The estimated risk for being in the aviation fixed wing occupational field is 88.4% of the hazard for those who are in the combat arms occupational field (controlling for other covariates). Therefore, the hazard of leaving before 10 YCS for aviation fixed wing officers goes down by an estimated 11.6%. The estimated risk for being in the aviation rotary wing occupational field is 81.9% of the hazard for those who are in the combat arms occupational field (controlling for other covariates). Therefore, the hazard of leaving before 10 YCS for aviation rotary wing officers goes down by an estimated 18.1%.

Table 46. Test Results for the Global Null Hypothesis: PROC PHREG by Occ Field – 10 YCS Retention Model

Test	Chi-Square	DF	Pr > Chi-Square
Likelihood Ratio	4981.326	31	<.0001
Score	5861.196	31	<.0001
Wald	4908.981	31	<.0001

(Source: Author, 2006)

Table 47. Analysis of Maximum Likelihood Estimates for PROC PHREG by Occupational Field – 10 YCS Retention Model

Variable	**Parameter Estimate**	**Standard Error**	**Chi-Square**	**Hazard Ratio**
Married	-0.195 ***	0.022	79.871	0.823
Comm_Age	0.029 ***	0.006	23.802	1.029
Female	0.010	0.054	0.036	1.010
African American	0.012	0.046	0.070	1.012
Hispanic	0.213 ***	0.054	15.290	1.237
Other Ethnic Group	0.091	0.058	2.467	1.095
TBS Percentile	-0.0006 *	0.0003	2.896	0.999
Prior Enlisted	0.263 ***	0.034	60.294	1.300
NROTC	0.022	0.027	0.652	1.022
USNA	0.069 **	0.033	4.362	1.072
OCC	-0.090 ***	0.028	10.255	0.914
MECEP	0.270 ***	0.057	22.545	1.311

Variable	Parameter Estimate	Standard Error	Chi-Square	Hazard Ratio
ECP	-0.154 **	0.060	6.583	0.857
Ground Support	-0.034	0.024	2.036	0.966
Service Support	-0.032	0.038	0.716	0.969
Aviation Fixed Wing	-0.123 ***	0.044	7.830	0.884
Aviation Rotary Wing	-0.200 ***	0.045	20.130	0.819
Aviation Support	-0.021	0.039	0.290	0.979
FY 81	-0.621 ***	0.047	177.560	0.538
FY 82	-0.579 ***	0.048	145.217	0.561
FY 83	-0.457 ***	0.046	97.979	0.633
FY 84	-0.242 ***	0.049	23.938	0.785
FY 85	0.024	0.051	0.224	1.025
FY 86	0.201 ***	0.052	15.115	1.223
FY 87	0.410 ***	0.052	62.650	1.507
FY 88	0.616 ***	0.054	132.643	1.851
FY 89	0.857 ***	0.052	272.084	2.355
FY 90	1.094 ***	0.055	394.722	2.987
FY 91	1.381 ***	0.054	648.193	3.979
FY 92	1.444 ***	0.054	724.904	4.239
FY 93	2.237 ***	0.057	1542.129	9.369

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

B. O-4 PROMOTION MODEL

1. Model Specifications for the O-4 Promotion Model

The model specification used in the O-4 Promotion model to estimate the dichotomous dependent variable, 'PROMO4,' is a binomial logistic regression equation because the predictors are both categorical and continuous, where as the dependent variable is binary. The discrete categorical variable has two possible values: promoted to O-4 (PROMO4 = 1) or not promoted to O-4 (PROMO4 = 0). Table 48 summarizes the functions used for the O-4 Promotion models.

Table 48. Specifications for the Logistic O-4 Promotion Models

1. PROMO4 = f (Gender, Marital Status, Ethnic Group, Commissioning Age, Commissioning Source, Commissioning Fiscal Year, Prior Enlisted, Third at TBS, PMOS)
2. PROMO4 = f (Gender, Marital Status, Ethnic Group, Commissioning Age, Commissioning Source, Commissioning Fiscal Year, Prior Enlisted, Third at TBS, Occupational Group)

(Source: Author, 2006)

2. Hypothesized Effects of the Independent Variables for the O-4 Promotion Model

The independent variables and their hypothesized effect on the dependent variable are the same as the 10 YCS Retention model because the promotion to O-4 usually occurs at 10 YCS. The overarching assumption is that certain officers have higher promotion rates because of their PMOS. This assumption is based on career opportunities at higher levels of command, where the need for combat arms officers is higher than that of officers in the supporting arms PMOSs. In addition, more and more emphasis is placed on joint duty and officers in combat arms PMOSs are more likely to have a joint tour than officers in a service support PMOS.

3. Descriptive Statistics for the O-4 Promotion Model

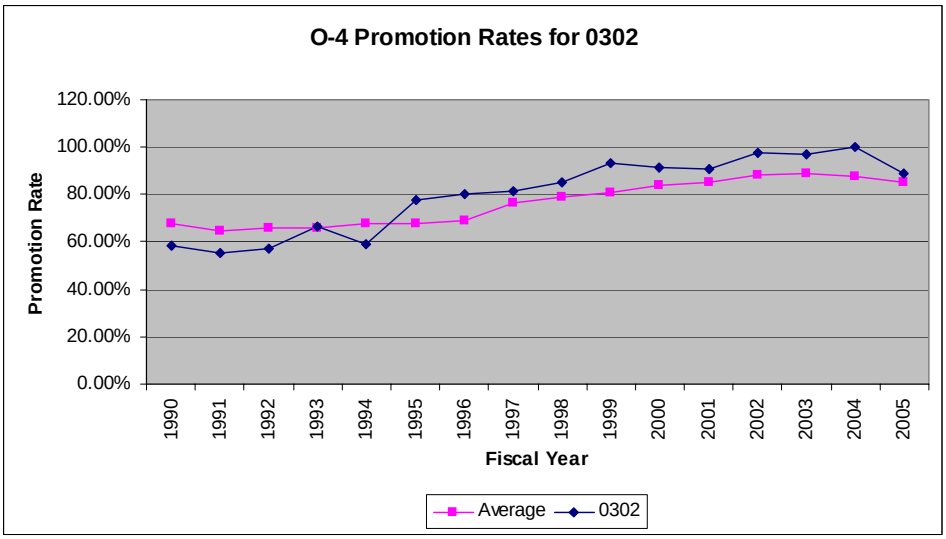
Officers in fiscal years 1994 through 1999 were deleted because they were not eligible for promotion to O-4. Those officers who leave (voluntarily or involuntarily) before the commencement of the O-4 promotion board or had missing data were deleted from the model. The number of observations who survived to the commencement of the O-4 promotion board was 11,776 and 9,669 (82.11%) were promoted to O-4. The numbers of observations by occupational field used in the O-4 promotion sample are shown in Table 49. The descriptive statistics for O-4 Promotion Model separated by occupational fields are shown in Tables 50 through 55. Appendix D shows promotion rates calculated from the official selection board results published by HQMC, Promotion Branch. The figures in Appendix D illustrate the comparison of each PMOS and the board average for all fiscal years analyzed. Figure 17 shows the O-4 promotion rates for infantry officers from 1990 through 2005, compared to the average promotion rate. Since, 1995 the promotion rate for infantry officers has been higher than the board average.

Table 49. Observations Used in the O-4 Promotion Sample

	COMBAT	GRDSUP	SERSUP	AVFIXED	AVROTARY	AVSUP	TOTALS
Prom = 0	413	455	137	519	460	123	2,107
Prom = 1	2,362	2,624	803	1,444	1,788	648	9,669
	2,775	3,079	940	1,963	2,248	771	11,776

(Source: Author, 2006)

Figure 17. Infantry Officer O-4 Promotion Rates from 1990 – 2005



(Source: Author, 2006)

Table 50. Proportions and Sample Means for Combat Arms Occupational Field – O-4 Promotion Model

Variable	**COMBAT**	**0302**	**0802**	**1802**	**1803**
Promoted to O-4	0.851	0.862	0.856	0.846	0.875
Prior Enlisted	0.200	0.213	0.191	0.154	0.203
OCC	0.187	0.192	0.172	0.163	0.203
NROTC	0.287	0.283	0.301	0.293	0.320
MECEP	0.046	0.051	0.051	0.024	0.031
ECP	0.042	0.043	0.033	0.048	0.023
USNA	0.115	0.100	0.150	0.149	0.063
Female	0	0	0	0	0
Comm_Age	23.146	23.150	23.190	22.913	23.141
Married	0.333	0.3110	0.354	0.389	0.383
African American	0.041	0.043	0.040	0.019	0.023
Hispanic	0.025	0.023	0.030	0.029	0.023
Other Ethnic	0.027	0.022	0.034	0.014	0.094
TBS_Middle Third	0.320	0.300	0.345	0.332	0.359
TBS_Bottom Third	0.256	0.236	0.291	0.250	0.344
TBS Percentile	56.755	59.253	52.705	57.334	47.522

(Source: Author, 2006)

Table 51. Proportions and Sample Means for Ground Support Occupational Field – O-4 Promotion Model

Variable	GRDSUP	0202	0206	0402	0602
Promoted to O-4	0.852	0.833	0.957	0.865	0.826
Prior Enlisted	0.285	0.325	0.500	0.248	0.295
OCC	0.250	0.213	0.217	0.278	0.206
NROTC	0.206	0.230	0.196	0.208	0.205
MECEP	0.073	0.123	0.130	0.053	0.112
ECP	0.053	0.093	0.022	0.041	0.055
USNA	0.099	0.093	0.174	0.094	0.105
Female	0.066	0.093	0.022	0.076	0.097
Comm_Age	23.639	23.932	24.13	23.481	23.682
Married	0.405	0.423	0.326	0.394	0.449
African American	0.079	0.022	0.065	0.085	0.089
Hispanic	0.034	0.038	0.043	0.033	0.036
Other Ethnic	0.031	0.046	0.043	0.026	0.028
TBS_Middle Third	0.310	0.301	0.239	0.322	0.321
TBS_Bottom Third	0.385	0.246	0.261	0.444	0.355
TBS Percentile	46.539	57.456	60.981	41.342	48.701

Variable	1302	3002	5803
Promoted to O-4	0.854	0.818	0.866
Prior Enlisted	0.230	0.230	0.493
OCC	0.227	0.309	0.246
NROTC	0.310	0.161	0.119
MECEP	0.036	0.017	0.134
ECP	0.012	0.049	0.157
USNA	0.128	0.112	0.037
Female	0.003	0.070	0.075
Comm_Age	23.215	23.600	24.627
Married	0.310	0.414	0.478
African American	0.033	0.144	0.104
Hispanic	0.036	0.030	0.015
Other Ethnic	0.033	0.038	0.030
TBS_Middle Third	0.337	0.285	0.343
TBS_Bottom Third	0.304	0.535	0.291
TBS Percentile	51.840	35.695	53.010

(Source: Author, 2006)

Table 52. Proportions and Sample Means for Service Support Occupational Field – O-4 Promotion Model

Variable	**SERSUP**	**0180**	**3404**	**4302**	**4402**
Promoted to O-4	0.854	0.789	0.829	0.852	0.872
Prior Enlisted	0.259	0.383	0.342	0.410	0.117
OCC	0.245	0.344	0.249	0.311	0.183
NROTC	0.174	0.141	0.228	0.115	0.101
MECEP	0.064	0.097	0.104	0.180	0.005
ECP	0.044	0.093	0.073	0.082	0
USNA	0.070	0.062	0.078	0.082	0.041
Female	0.170	0.308	0.192	0.230	0.065
Comm_Age	23.849	24.357	23.793	24.098	23.684
Married	0.395	0.471	0.425	0.475	0.387
African American	0.079	0.123	0.109	0.066	0.041
Hispanic	0.036	0.040	0.036	0.033	0.035
Other Ethnic	0.033	0.031	0.026	0	0.033
TBS_Middle Third	0.394	0.282	0.358	0.393	0.341
TBS_Bottom Third	0.355	0.559	0.394	0.377	0.264
TBS Percentile	48.395	35.319	43.960	43.895	55.393

(Source: Author, 2006)

Table 53. Proportions and Sample Means for Aviation Fixed Wing Occupational Field – O-4 Promotion Model

Variable	**AVFIXED**	**7509**	**7523**	**7543**	**7556**
Promoted to O-4	0.736	0.676	0.749	0.657	0.687
Prior Enlisted	0.131	0.132	0.140	0.093	0.217
OCC	0.172	0.161	0.160	0.179	0.222
NROTC	0.146	0.120	0.138	0.121	0.091
MECEP	0.013	0.002	0.004	0.014	0.026
ECP	0.014	0.012	0.008	0.021	0
USNA	0.145	0.113	0.110	0.107	0.065
Female	0.002	0	0.002	0	0
Comm_Age	22.941	22.984	22.854	22.814	23.439
Married	0.309	0.223	0.218	0.336	0.348
African American	0.015	0.005	0.016	0.014	0.030
Hispanic	0.023	0.029	0.016	0	0.061
Other Ethnic	0.015	0.022	0.016	0	0.004
TBS_Middle Third	0.343	0.348	0.317	0.421	0.378
TBS_Bottom Third	0.184	0.149	0.162	0.200	0.335
TBS Percentile	61.209	63.543	63.996	56.752	49.255

(Source: Author, 2006)

Table 54. Proportions and Sample Means for Aviation Rotary Wing Occupational Field – O-4 Promotion Model

Variable	ROTARY	7562	7563	7564	7565	7566
Promoted to O-4	0.795	0.795	0.809	0.745	0.856	0.802
Prior Enlisted	0.135	0.131	0.136	0.090	0.124	0.176
OCC	0.177	0.187	0.155	0.200	0.162	0.204
NROTC	0.161	0.158	0.188	0.138	0.174	0.135
MECEP	0.013	0.014	0.013	0.013	0.011	0.017
ECP	0.014	0.013	0.019	0.007	0.014	0.014
USNA	0.121	0.138	0.068	0.121	0.094	0.138
Female	0.004	0.004	0.003	0.003	0	0.008
Comm_Age	23.005	23.030	23.052	23.017	22.849	23.160
Married	0.310	0.323	0.340	0.403	0.249	0.289
African American	0.026	0.021	0.003	0.059	0.025	0.030
Hispanic	0.036	0.032	0.042	0.024	0.030	0.050
Other Ethnic	0.029	0.019	0.045	0.017	0.039	0.033
TBS_Middle Third	0.362	0.364	0.395	0.334	0.341	0.394
TBS_Bottom Third	0.305	0.295	0.239	0.455	0.236	0.331
TBS Percentile	51.107	51.275	55.136	41.712	57.066	48.464

(Source: Author, 2006)

Table 55. Proportions and Sample Means for Aviation Support Occupational Field – O-4 Promotion Model

Variable	AVSUP	6002	6602	7202
Promoted to O-4	0.840	0.852	0.804	0.850
Prior Enlisted	0.311	0.403	0.297	0.270
OCC	0.215	0.176	0.277	0.248
NROTC	0.198	0.114	0.209	0.197
MECEP	0.099	0.136	0.101	0.066
ECP	0.091	0.119	0.061	0.109
USNA	0.091	0.091	0.155	0.044
Female	0.061	0.074	0.095	0
Comm_Age	24.030	24.642	23.919	23.803
Married	0.470	0.483	0.541	0.438
African American	0.057	0.057	0.088	0.036
Hispanic	0.036	0.011	0.034	0.051
Other Ethnic	0.035	0.045	0.041	0.022
TBS_Middle Third	0.340	0.330	0.324	0.387
TBS_Bottom Third	0.316	0.267	0.385	0.255
TBS Percentile	50.526	53.994	45.680	53.652

(Source: Author, 2006)

4. Logistic Regression Estimates for the O-4 Promotion Model

The classification table results shown in Table 56, predicts the accuracy of the logistic regression model where the observed values for the dependent outcome and the

predicted values are cross classified at a cut off value where p = 0.82. The O-4 promotion model correctly predicts 61.7% of the O-4 promotion decisions. The Likelihood Ratio, Score, and Wald statistics test the global null hypothesis that all Betas = 0, are significant at the 1% level. Therefore, at least one Beta is not equal to zero and the global null hypothesis is rejected.

A list of variables used in the logistic regression models and their coefficients, standard errors, chi-squared values, partial effects and odds ratios are shown in Tables 57 and 58. The results of the logistic model for O-4 promotions show that ten out of thirty-one PMOSs were significant in determining whether an officer is promoted to O-4, when compared to the base case (infantry officer).

Table 56. Classification Table for the O-4 Promotion Model

Observed		Predicted		Percentage Correct
		Promote O-4 = 0	Promote O-4 = 1	
Promote O-4 = 0	2,107	1,225	882	58.1
Promote O-4 = 1	9,669	3,632	6,037	62.4
Prob Level	.82			
Overall Percentage				61.7

(Source: Author, 2006)

Table 57. Logistic Estimates for the O-4 Promotion Model with PMOS

Variable	**Coefficient**	**Std Error**	**Chi-Square**	**Partial Effect**	**Odds Ratio**
Intercept	0.840	0.374	5.034	-0.000	
Married	-0.021	0.056	0.141	-0.003	0.979
Comm_Age	0.005	0.016	0.103	0.001	1.005
Female	0.196	0.153	1.637	0.028	1.216
African American	-0.206 *	0.111	3.434	-0.033	0.814
Hispanic	-0.118	0.140	0.709	-0.019	0.889
Other Ethnic Group	-0.111	0.156	0.511	-0.017	0.895
TBS Percentile	0.010 ***	0.001	114.988	0.002	1.100
Prior Enlisted	0.090	0.094	0.919	0.013	1.094
NROTC	-0.191 ***	0.070	7.415	-0.031	0.827
USNA	-0.110	0.084	1.725	-0.017	0.896
OCC	0.188 **	0.078	5.854	0.027	1.207

Variable	Coefficient	Std Error	Chi-Square	Partial Effect	Odds Ratio
MECEP	-0.917 ***	0.152	36.197	-0.178	0.400
ECP	-0.498 ***	0.160	9.759	-0.088	0.608
Adjutant	-0.215	0.184	1.371	-0.035	0.806
Intelligence	-0.049	0.156	0.098	-0.008	0.952
Signals Intelligence	1.164	0.733	2.524	0.120	3.203
Logistics	0.275 **	0.119	5.345	0.038	1.316
Communications	-0.034	0.120	0.081	-0.005	0.967
Artillery	0.168	0.119	2.006	0.024	1.183
Engineer	0.062	0.168	0.134	0.009	1.064
Tank	0.053	0.204	0.068	0.008	1.055
AAV	0.355	0.278	1.627	0.048	1.426
Supply	-0.038	0.138	0.076	-0.006	0.963
Finance	0.043	0.206	0.043	0.006	1.044
Public Affairs	0.164	0.374	0.193	0.024	1.178
Judge Advocate	0.139	0.171	0.667	0.020	1.149
MP	0.275	0.267	1.068	0.038	1.317
Aircraft Maintenance	0.114	0.225	0.257	0.017	1.121
Aviation Supply	-0.128	0.220	0.337	-0.020	0.880
LAAD	0.132	0.252	0.276	0.019	1.142
Air Support Control	0.116	0.249	0.216	0.017	1.123
Air Defense Control	0.328	0.263	1.548	0.045	1.388
Air Traffic Control	0.337	0.413	0.666	0.046	1.401
AV8B	-1.215 ***	0.125	95.086	-0.250	0.297
FA18	-0.881 ***	0.123	51.283	-0.170	0.414
EA6B	-1.140 ***	0.192	35.219	-0.231	0.320
C130	-1.123 ***	0.160	49.418	-0.227	0.325
CH46	-0.392 ***	0.102	14.706	-0.067	0.675
UH1	-0.377 **	0.159	5.622	-0.064	0.686
CH53A_D	-0.504 ***	0.151	11.150	-0.089	0.604
AH1	-0.034	0.151	0.052	-0.005	0.966
CH53E	-0.378 **	0.147	6.615	-0.064	0.685
A6E	-0.135	0.342	0.156	-0.021	0.874
EA6B Electronic	-0.554 ***	0.207	7.179	-0.099	0.575
FY 81	.035	0.117	0.089	0.005	1.036
FY 82	0.066	0.116	0.324	0.010	1.068
FY 83	0.267 **	0.111	5.795	0.037	1.306
FY 84	-0.029	0.111	0.067	-0.004	0.972
FY 85	0.342 ***	0.121	8.004	0.047	1.407
FY 86	0.030	0.108	0.077	0.005	1.030
FY 87	0.214 *	0.110	3.812	0.030	1.239
FY 88	0.531 ***	0.120	19.624	0.068	1.701
FY 89	0.586 ***	0.113	26.722	0.074	1.797
FY 90	0.694 ***	0.126	30.569	0.084	2.002

Variable	Coefficient	Std Error	Chi-Square	Partial Effect	Odds Ratio
FY 91	0.898 ***	0.129	48.664	0.101	2.454
FY 92	0.769 ***	0.126	36.949	0.091	2.157
FY 93	0.626 ***	0.119	27.732	0.078	1.871

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

The partial effect value describes the percentage change in the predicted probability for a base case officer with average values for continuous variables and binary variables equal to zero. The partial effect estimate which explains whether an officer is more or less likely to be promoted to O-4, than the base case, depending on the sign, is used to compare officers in different PMOSs or occupational fields to an average base case officer. (Here a positive sign means more likely, and a negative sign means less likely, than the base case to be promoted to O-4). The base case is a single white male who was non-prior service, who was commissioned through PLC, finished in the top third at TBS, held an 0302 (Infantry) PMOS, and was commissioned in FY 1980.

The results of the logistic regression model show these focus variables as significant when analyzing O-4 promotions: logistic officers, aviation fixed and rotary wing pilots (except AH1 and A6E). The Logistics PMOS has a positive coefficient and the coefficient is significant at the 5% level. According to the model, a logistics officer who has all the other base-case attributes is 3.83% more likely to be promoted to O-4 than an officer whose attributes are entirely those of the base case. The odds of any logistics officer being promoted to O-4 are 1.316 times (that is, 31.6% greater than) the odds of an infantry officer with otherwise identical attributes.

The FA18 PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an FA18 pilot who has all the other base-case attributes is 17.0% less likely to be promoted to O-4 than an officer whose attributes are entirely those of the base case. The odds of any FA18 pilot being promoted to O-4 are 0.414 times (that is, 58.6% less than) the odds of an infantry officer with otherwise identical attributes. The AV8B PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an AV8B pilot who has all the other base-case attributes is 25.0% less likely to be promoted to O-4 than an officer whose

attributes are entirely those of the base case. The odds of any AV8B pilot being promoted to O-4 are 0.297 times (that is, 70.3% less than) the odds of an infantry officer with otherwise identical attributes.

The OCC commissioning source has a positive coefficient and the coefficient is significant at the 5% level. According to the model, an officer commissioned through OCC who has all the other base-case attributes is 2.7% more likely to be promoted to O-4 than an officer whose attributes are entirely those of the base case. The odds of any officer commissioned through OCC being promoted to O-4 are 1.207 times (that is, 20.7% greater than) the odds of an officer commissioned through PLC with otherwise identical attributes.

The percentile in which an officer graduates TBS is positively associated with the likelihood of being promoted to O-4 and the results are significant at the 1% level. The odds ratio of 1.010 for TBS class standing percentile says that under the model, each one-percent increase in class standing is associated with a 0.1% increase in the predicted odds of being promoted to O-4.

Table 58. Logistic Estimates for the O-4 Promotion Model with Occupational Fields

Variable	Coefficient	Standard Error	Chi-Square	Partial Effect	Odds Ratio
Intercept	1.030	0.373	7.619	0.000	
Married	-0.013	0.056	0.057	-0.002	0.987
Comm_Age	0.002	0.016	0.016	0	1.002
Female	0.137	0.150	0.844	0.018	1.147
African American	-0.216	0.110	3.830	-0.032	0.806
Hispanic	-0.128	0.139	0.849	-0.019	0.880
Other Ethnic Group	-0.101	0.155	0.425	-0.015	0.904
TBS Percentile	0.010 ***	0.001	129.459	0.001	1.010
Prior Enlisted	0.089	0.094	0.887	0.012	1.092
NROTC	-0.183 ***	0.069	6.959	-0.027	0.833
USNA	-0.057	0.083	0.470	-0.008	0.945
OCC	0.189 **	0.078	5.966	0.025	1.208
MECEP	-0.938 ***	0.151	38.495	-0.172	0.391
ECP	-0.503 ***	0.159	10.072	-0.082	0.605
Ground Support	-0.036	0.074	0.236	-0.005	0.965
Service Support	-0.068	0.104	0.418	-0.010	0.935
Aviation Fixed Wing	-1.036 ***	0.077	182.017	-0.194	0.355
Aviation Rotary Wing	-0.479 ***	0.076	39.725	-0.077	0.620
Aviation Support	0.014	0.114	0.014	0.002	1.014

Variable	Coefficient	Standard Error	Chi-Square	Partial Effect	Odds Ratio
FY 81	0.047	0.117	0.159	0.006	1.048
FY 82	0.065	0.115	0.319	0.009	1.067
FY 83	0.266 **	0.111	5.800	0.034	1.305
FY 84	-0.037	0.111	0.113	-0.005	0.963
FY 85	0.318 ***	0.120	6.999	0.040	1.375
FY 86	0.019	0.108	0.032	0.003	1.019
FY 87	0.201 *	0.109	3.409	0.026	1.223
FY 88	0.498 ***	0.119	17.473	0.058	1.645
FY 89	0.556 ***	0.113	24.336	0.064	1.744
FY 90	0.676 ***	0.125	29.220	0.074	1.967
FY 91	0.868 ***	0.128	45.881	0.089	2.382
FY 92	0.752 ***	0.126	35.630	0.081	2.121
FY 93	0.586 ***	0.118	24.569	0.002	1.797

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

Table 58 shows that two occupational fields had a significant negative effect on promotion to O-4. The results of the logistic regression model, when occupational fields are the focus variables, show that aviation fixed wing and rotary wing pilots are less likely to be promoted than the base case. The aviation fixed wing occupational field has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an officer in the aviation fixed wing occupational field that has all the other base-case attributes is 19.4% less likely to be promoted to O-4 than an officer whose attributes are entirely those of the base case. The odds of any officer in the aviation fixed wing occupational field being promoted to O-4 are 0.355 times (that is, 64.5% less than) the odds of a combat arms officer with otherwise identical attributes. The aviation rotary wing occupational field has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an officer in the aviation rotary wing occupational field who has all the other base-case attributes is 7.74% less likely to be promoted to O-4 than an officer whose attributes are entirely those of the base case. The odds of any officer in the aviation rotary wing occupational field being promoted to O-4 are 0.620 times (that is, 38% less than) the odds of a combat arms officer with otherwise identical attributes.

5. PROC LIFETEST Results for the O-4 Promotion Model

The Kaplan-Meier method was used in the O-4 promotion models to test whether promotion functions were identical for different occupational fields or PMOSs. The LIFETEST procedure examined 16,418 officers of which 6,749 observations were censored. Table 59 gives the quartile point estimates, where the probability of being promoted to O-4 being greater than .75 occurs at 236 months of commissioned service. The point estimate for the 50% quartile is 193 months and the 95% confidence interval gives lower and upper ranges of 192 and 196 respectively. The mean given by the LIFETEST procedure yields 196.617 months and a standard error of 0.470, but the "median is usually a much preferred measure of central tendency for censored survival data."[54]

Table 59. PROC LIFETEST Procedure with Kaplan-Meier Summary Statistics – O-4 Promotion Model

		95% Confidence Interval	
%	Point Estimate	Lower	Upper
75	236	235	237
50	193	192	196
19625	156	153	156

(Source: Author, 2006)

The LIFETEST procedure produces graphs that compare two different groups in order to determine if they have identical promotion patterns. This procedure in SAS was used to evaluate different PMOSs and occupational fields and the results illustrate which PMOS or occupational field are promoted with the least amount of commissioned months. Figure 18 illustrates the different promotion patterns for the six occupational fields, where each occupational field has a separate promotion function depicted by one of six different colors. Figure 18 shows that officers in the aviation fixed and rotary wing occupational fields are promoted faster than officers in combat arms.

Table 60 presents the summary of the number of censored and uncensored values and the rank statistics for the six occupational fields. Table 61 shows that the Test of Equality over Strata and the results of the Log-rank and Wilcoxon tests are significant for occupational groupings (the p-values for both tests, given in the Pr > chi-square column,

[54] Paul D. Allison, Survival Analysis Using SAS (SAS Publishing, North Carolina, 2003), p.47.

are <.0001). The null hypothesis that there is no difference in the number of months to O-4 among the different occupational fields is rejected. Table 62 shows that the Test of Equality over Strata and the results of the Log-rank and Wilcoxon tests are significant for PMOSs (the p-values for both tests, given in the Pr > chi-square column, are <.0001). The null hypothesis that there is no difference in the number of months to O-4 among the different PMOSs is rejected.

Table 60. Summary of Censored and Uncensored Values with Test Statistics – O-4 Promotion Model

Source	Total	Failed	Censored	Percent Censored	Log-Rank	Wilcoxon
Combat Arms	4,091	2,533	1,558	38.08	-348.19	-1970796
Ground Support	4,028	2,467	1,561	38.75	60.36	214131
Service Support	1,392	711	681	48.92	-23.93	-163616
Aviation Fixed	2,607	1,378	1,229	47.14	254.29	1922522
Aviation Rotary	3,149	1,876	1,273	40.43	48.52	253258
Aviation Support	1,151	704	447	38.84	8.96	-255499

(Source: Author, 2006)

Table 61. Testing Homogeneity of O-4 Promotion Functions for the Different Occupational Fields

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	107.850	5	<.0001
Wilcoxon	132.765	5	<.0001
-2Log (LR)	10.078	5	0.0731

(Source: Author, 2006)

Appendix B shows LIFETEST graphs for each occupational field and a selected PMOS within each of the six occupational fields for O-4 promotions. Table 62 shows the test results for homogeneity for the different PMOSs. Table 63 shows the test results for homogeneity for officers in the combat arms occupational field. Table 64 shows the test results for homogeneity for infantry officers. In all three cases the null hypothesis is rejected, therefore the promotion patterns are not identical. Figure 19 displays the promotion patterns for combat arms officers. Figure 20 displays the promotion patterns of infantry officers.

Table 62. Testing Homogeneity of O-4 Promotion Functions for the Different PMOSs

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	1023.0579	43	<.0001
Wilcoxon	988.2372	43	<.0001
-2Log (LR)	103.4694	43	<.0001

(Source: Author, 2006)

Table 63. Testing Homogeneity of O-4 Promotion Functions for Combat Arms

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	62.862	1	<.0001
Wilcoxon	58.106	1	<.0001
-2Log (LR)	0.398	1	0.528

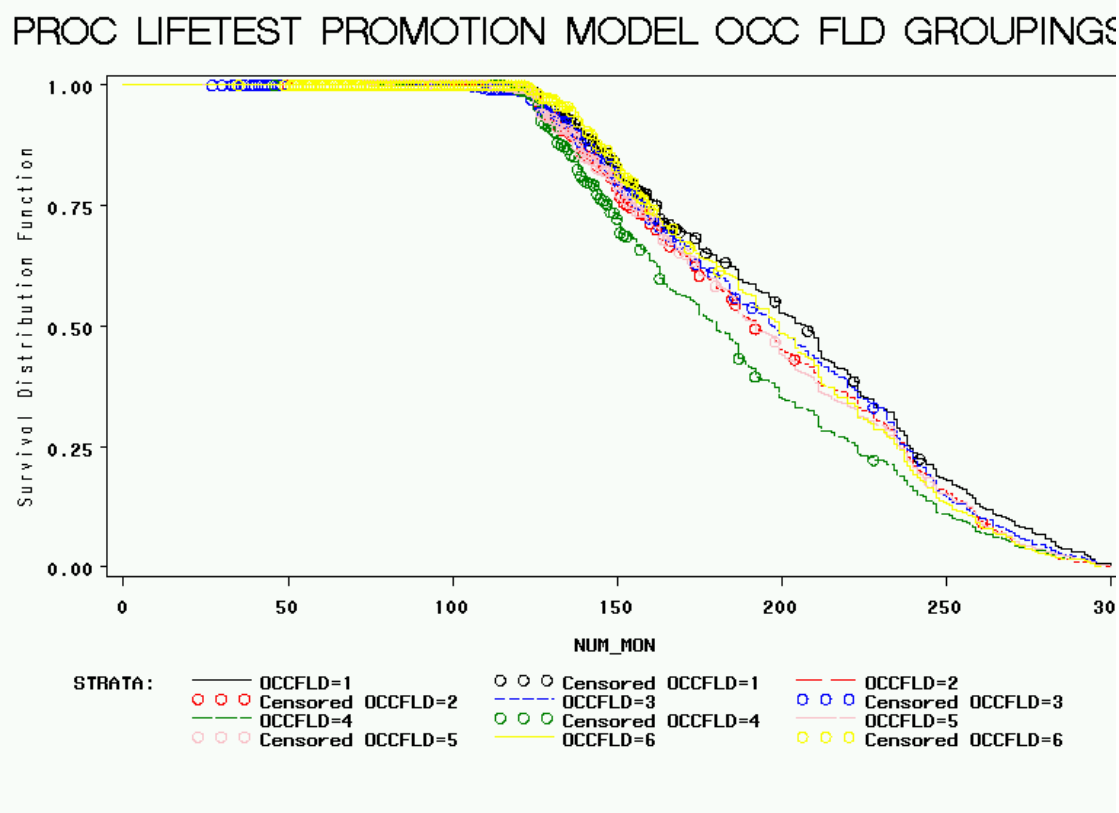
(Source: Author, 2006)

Table 64. Testing Homogeneity of O-4 Promotion Functions for the Infantry Officers

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	29.283	1	<.0001
Wilcoxon	21.171	1	<.0001
-2Log (LR)	1.222	1	0.269

(Source: Author, 2006)

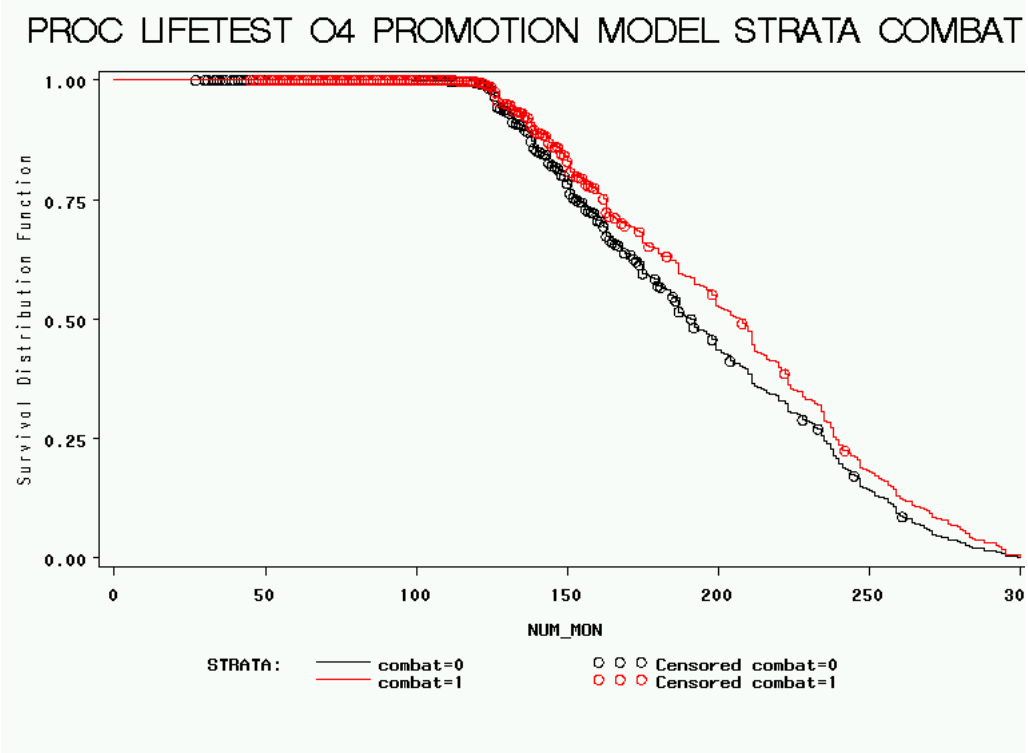
Figure 18. Graph of PROC LIFETEST with Occupational Field Groupings – O-4 Promotion Model



Occupational Field 1 – Combat Arms: black
Occupational Field 2 – Ground Support: red
Occupational Field 3 – Service Support: blue
Occupational Field 4 – Aviation Fixed Wing: green
Occupational Field 5 – Aviation Rotary Wing: pink
Occupational Field 6 – Aviation Support: yellow
(Source: Author, 2006)

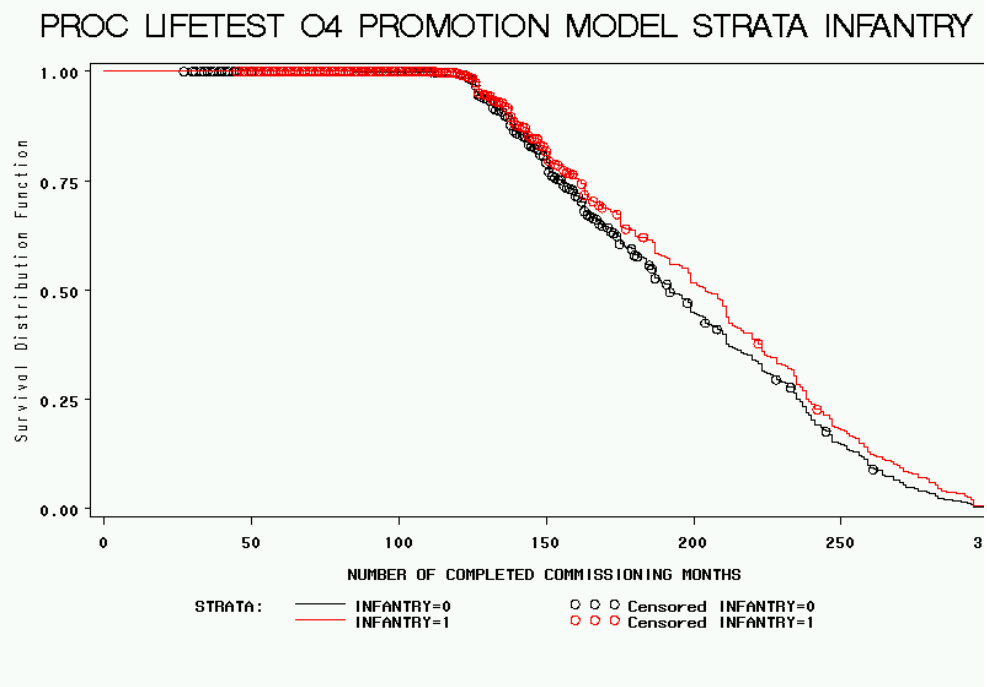
Figure 19 shows officers who survived until the O-4 promotion board and are either combat arms or non-combat arms. The officers in the non-combat arms occupational fields are promoted faster. Figure 20 shows the officers who survived until the O-4 promotion board and are infantry officers or non-infantry officers. Infantry officers are promoted slower than non-infantry officers.

Figure 19. Graph of PROC LIFETEST for Combat Arms Occupational Field – O-4 Promotion Model



Combat Arms = 0 (Black) Combat Arms = 1 (Red)
(Source: Author, 2006)

Figure 20. Graph of PROC LIFETEST for Infantry Officers – O-4 Promotion Model



Infantry = 0 (Black) Infantry = 1 (Red)

(Source: Author, 2006)

6. Cox Regression Estimates for the O-4 Promotion Model

The number of observations used in the PHREG procedure was 11,776 where 2,107 values were censored. Table 65 shows the results of the global null hypothesis: Beta = 0 when PMOSs are included in the model. The results of each test are significant and the null hypothesis is rejected. Table 66 shows the parameter estimates, standard errors, Chi-squared values and hazard ratios for the variables used in the Cox regression model used to analyze O-4 promotion patterns.

The significant variables in the Cox regression model include: married, commissioning age, Hispanic, prior enlisted, NROTC, USNA, MECEP, and each fiscal year. The significant focus variables include: intelligence, signals intelligence, logistics, communications, artillery, finance, public affairs, judge advocate, MP, aircraft maintenance, AV8B, F/A 18, EA6B, C130, UH1, AH1, and CH53_E.

The estimated risk for married officers is 81.3% of the hazard for those who are single (controlling for other covariates). Therefore, the hazard of being passed over for promotion to O-4 for married officers goes down by an estimated 16.9%. The estimated risk for Hispanic officers is 118.5% of the hazard for those who are white (controlling for other covariates). Therefore, the hazard of being passed over for promotion to O-4 for Hispanic officers goes up by an estimated 18.5%. The estimated risk for Finance officers is 125.5% of the hazard for those who are infantry officers (controlling for other covariates). Therefore, the hazard of being passed over for promotion to O-4 for Finance officers goes up by an estimated 25.5%. The estimated risk for Signals Intelligence officers is 43.2% of the hazard for those who are infantry officers (controlling for other covariates). Therefore, the hazard of being passed over for promotion to O-4 for Signals Intelligence officers goes down by an estimated 56.8%.

Table 65. Test Results for the Global Null Hypothesis: PROC PHREG by PMOS – O-4 Promotion Model

Test	Chi-Square	DF	Pr > Chi-Square
Likelihood Ratio	8968.498	57	<.0001
Score	11161.407	57	<.0001
Wald	8549.731	57	<.0001

(Source: Author, 2006)

Table 66. Analysis of Maximum Likelihood Estimates for PROC PHREG by PMOS – O-4 Promotion Model

Variable	**Parameter Estimate**	**Standard Error**	**Chi-Square**	**Hazard Ratio**
Married	-0.185 ***	0.024	60.315	0.831
Comm_Age	0.020 ***	0.006	9.810	1.020
Female	0.076	0.059	1.690	1.079
African American	-0.072	0.051	1.946	0.931
Hispanic	0.170 ***	0.060	7.938	1.185
Other Ethnic Group	0.095	0.063	2.297	1.100
TBS Percentile	0.0004	0.000	1.043	1.000
Prior Enlisted	0.186 ***	0.036	26.608	1.205
NROTC	0.061 **	0.029	4.387	1.063
USNA	0.107 ***	0.036	9.013	1.110
OCC	-0.005	0.030	0.032	0.995
MECEP	0.308 ***	0.063	23.568	1.361
ECP	-0.056	0.066	0.699	0.946
Adjutant	0.112	0.082	1.855	1.118
Intelligence	0.207 ***	0.063	10.910	1.230
Signals Intelligence	-0.839 ***	0.157	28.407	0.432

Variable	Parameter Estimate	Standard Error	Chi-Square	Hazard Ratio
Logistics	0.154 ***	0.044	12.092	1.166
Communications	0.162 ***	0.049	10.967	1.175
Artillery	0.085 *	0.045	3.598	1.089
Engineer	-0.042	0.064	0.435	0.959
Tank	-0.027	0.079	0.115	0.974
AAV	0.096	0.098	0.967	1.101
Supply	-0.071	0.057	1.571	0.931
Finance	0.227 ***	0.084	7.374	1.255
Public Affairs	0.544 ***	0.142	14.698	1.723
Judge Advocate	0.140 **	0.061	5.229	1.151
MP	0.215 **	0.097	4.942	1.239
Aircraft Maintenance	0.231 ***	0.086	7.272	1.260
Aviation Supply	0.150	0.095	2.479	1.161
LAAD	0.145	0.096	2.285	1.156
Air Support Control	0.110	0.097	1.284	1.116
Air Defense Control	0.128	0.094	1.836	1.136
Air Traffic Control	0.040	0.146	0.076	1.041
AV8B	0.288 ***	0.065	19.851	1.333
FA18	0.466 ***	0.057	65.654	1.593
EA6B	0.318 ***	0.107	8.782	1.374
C130	0.347 ***	0.084	17.114	1.415
CH46	0.058	0.044	1.758	1.060
UH1	0.173 **	0.068	6.517	1.189
CH53A_D	0.020	0.072	0.072	1.020
AH1	0.203 ***	0.057	12.610	1.225
CH53E	0.278 ***	0.064	19.088	1.321
A6E	-0.095	0.141	0.454	0.909
EA6B Electronic	0.100	0.094	1.128	1.105
FY 81	-0.565 ***	0.051	105.401	0.568
FY 82	-0.399 ***	0.056	51.441	0.671
FY 83	-0.151 ***	0.053	8.113	0.860
FY 84	0.106 *	0.059	3.278	1.112
FY 85	0.589 ***	0.060	96.749	1.803
FY 86	0.941 ***	0.061	241.049	2.563
FY 87	1.337 ***	0.061	479.644	3.809
FY 88	1.693 ***	0.063	713.444	5.437
FY 89	2.089 ***	0.063	1110.917	8.080
FY 90	2.534 ***	0.066	1474.900	12.602
FY 91	3.021 ***	0.066	2114.668	20.517
FY 92	2.875 ***	0.061	2216.871	17.723
FY 93	4.270 ***	0.072	3529.542	71.486

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

Table 67 shows the results of the global null hypothesis: Beta = 0 when occupational fields are included in the model. The results of each test are significant and the null hypothesis is rejected. Table 68 shows the parameter estimates, standard errors, chi-squared values and hazard ratios for the variables used in the Cox regression model used to analyze O-4 promotion patterns when occupational fields are included. The significant focus variables include ground support, service support, aviation fixed wing, aviation rotary wing and aviation support. The estimated risk for Service Support officers is 114.9% of the hazard for those who are in the combat arms occupational field (controlling for other covariates). Therefore, the hazard of being passed over for promotion to O-4 for Service Support officers goes up by an estimated 14.9%.

Table 67. Test Results for the Global Null Hypothesis: PROC PHREG by Occ Field – O-4 Promotion Model

Test	Chi-Square	DF	Pr > Chi-Square
Likelihood Ratio	8821.016	31	<.0001
Score	11070.457	31	<.0001
Wald	8573.616	31	<.0001

(Source: Author, 2006)

Table 68. Analysis of Maximum Likelihood Estimates for PROC PHREG by Occ Field – O-4 Promotion Model

Variable	**Parameter Estimate**	**Standard Error**	**Chi-Square**	**Hazard Ratio**
Married	-0.179 ***	0.024	57.285	0.836
Comm_Age	0.021 ***	0.006	11.311	1.022
Female	0.100 *	0.057	3.103	1.105
African American	-0.062	0.051	1.505	0.939
Hispanic	0.172 ***	0.060	8.138	1.187
Other Ethnic Group	0.099	0.063	2.488	1.104
TBS Percentile	0.000007	0.000	0.031	1.000
Prior Enlisted	0.160 ***	0.036	19.677	1.174
NROTC	0.061 **	0.029	4.473	1.063
USNA	0.090 **	0.035	6.360	1.094
OCC	-0.010	0.030	0.108	0.990
MECEP	0.328 ***	0.063	27.272	1.388
ECP	-0.035	0.066	0.275	0.966
Ground Support	0.051 *	0.028	3.257	1.053
Service Support	0.139 ***	0.040	11.854	1.149
Aviation Fixed Wing	0.195 ***	0.034	32.785	1.216
Aviation Rotary Wing	0.100 ***	0.031	10.449	1.105
Aviation Support	0.117 ***	0.043	7.323	1.125
FY 81	-0.550 ***	0.055	100.308	0.577

Variable	Parameter Estimate	Standard Error	Chi-Square	Hazard Ratio
FY 82	-0.376 ***	0.055	45.922	0.687
FY 83	-0.131 **	0.053	6.203	0.877
FY 84	0.135 **	0.058	5.325	1.144
FY 85	0.608 ***	0.060	103.822	1.837
FY 86	0.965 ***	0.060	256.052	2.624
FY 87	1.349 ***	0.061	493.123	3.852
FY 88	1.703 ***	0.063	730.955	5.491
FY 89	2.106 ***	0.062	1145.115	8.219
FY 90	2.542 ***	0.066	1504.612	12.700
FY 91	3.026 ***	0.065	2155.903	20.616
FY 92	2.804 ***	0.060	2180.954	16.506
FY 93	4.264 ***	0.071	3576.286	71.057

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

C. O-5 PROMOTION MODEL

The model specifications used in the O-5 Promotion model to estimate the dichotomous dependent variable, 'PROMO5,' is a binomial logistic regression equation because the predictors are both categorical and continuous, where as the dependent variable is binary. The discrete categorical variable has two possible values: promoted to O-5 (PROMO5 = 1) or not promoted to O-5 (PROMO5 = 0). Table 69 summarizes the functions used for the O-5 Promotion models.

Table 69. Specifications for the O-5 Promotion Model Models

1. PROMO5 = f (Gender, Marital Status, Ethnic Group, Commissioning Age, Commissioning Source, Commissioning Fiscal Year, Prior Enlisted, Third at TBS, PMOS)
2. PROMO5 = f (Gender, Marital Status, Ethnic Group, Commissioning Age, Commissioning Source, Commissioning Fiscal Year, Prior Enlisted, Third at TBS, Occupational Group)

(Source: Author, 2006)

2. Hypothesized Effects of the Independent Variables for the O-5 Promotion Model

The independent variables and their hypothesized affect on the dependent variable are the same as the 10 YCS Retention Model, as shown in Table 27. The overarching assumption is that officers have higher promotion rates to O-5 because of their PMOS. In addition those officers who are more likely to command battalions or artillery batteries

are more likely to be promoted to O-5 based on the requirements listed on the GAR. This assumption is based on career opportunities at higher levels of command where the need for combat arms officers is higher than supporting arms officers. In addition, more and more emphasis is placed on joint duty for promotion to O-5 and officers in combat arms PMOSs are more likely to have a joint tour when compared to an officer in a ground support PMOS.

3. Descriptive Statistics for O-5 Promotion Model

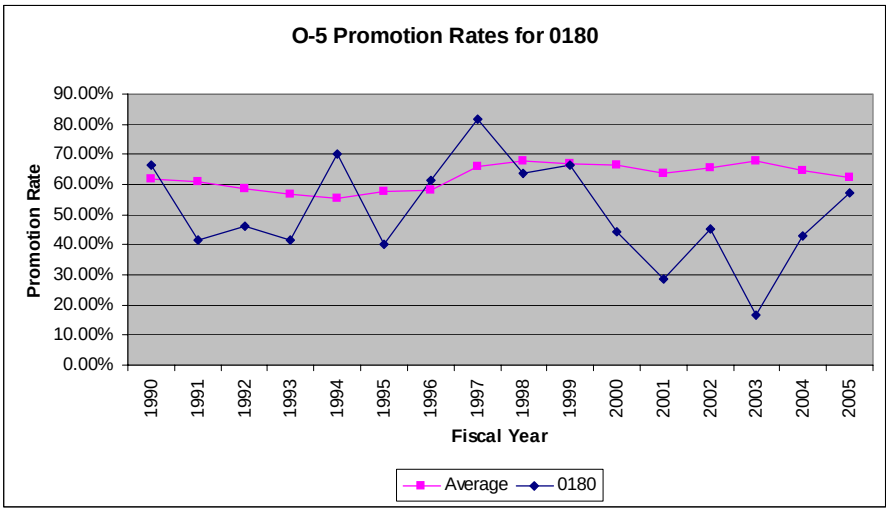
Officers in fiscal years 1989 through 1999 were deleted because they were not eligible for promotion to O-5. Those officers who leave (voluntarily or involuntarily) before the commencement of the O-5 promotion board or had missing data were deleted. The number of observations who survived to the commencement of the O-5 promotion board was 5,737 and 3,756 (65.47%) were promoted to O-5. The numbers of observations, by occupational field, used in the O-5 promotion sample are shown in Table 70. The descriptive statistics for the O-5 Promotion Model separated by PMOS and occupational field are shown in Tables 71 through 76. Appendix D shows O-5 promotion rates calculated from the official selection board results published by HQMC, Promotion Branch. The figures in Appendix D illustrate the comparison of each PMOS and the board average for all fiscal years analyzed. Figure 21 shows the O-5 promotion rates for Adjutants from 1990 through 2005, compared to the average promotion rate. Since, 1998 the promotion rate for Adjutants is lower than the board average.

Table 70. Observations Used in the O-5 Promotion Sample

	COMBAT	GRDSUP	SERSUP	AVFIXED	AVROTARY	AVSUP	TOTALS
Prom = 0	480	595	151	255	371	129	1,981
Prom = 1	1,021	955	337	511	648	284	3,756
	1,501	1,550	488	766	1,019	413	5,737

(Source: Author, 2006)

Figure 21. O-5 Promotion Rates for 0180



(Source: Author, 2006)

Table 71. Proportions and Sample Means for Combat Arms Occupational Field – O-5 Promotion Model

Variable	**COMBAT**	**0302**	**0802**	**1802**	**1803**
Promoted to O-5	0.680	0.697	0.687	0.664	0.597
Prior Enlisted	0.121	0.127	0.119	0.082	0.075
OCC	0.187	0.188	0.189	0.173	0.179
NROTC	0.277	0.266	0.301	0.309	0.314
MECEP	0.031	0.038	0.027	0	0.015
ECP	0.045	0.046	0.045	0.045	0
USNA	0.101	0.088	0.132	0.118	0.075
Female	0	0	0	0	0
Comm_Age	22.940	22.981	22.920	22.745	22.701
Married	0.394	0.395	0.393	0.382	0.433
African American	0.041	0.049	0.035	0.027	0.015
Hispanic	0.021	0.021	0.020	0.018	0.045
Other Ethnic	0.027	0.020	0.037	0.009	0.119
TBS_Middle Third	0.312	0.305	0.303	0.373	0.343
TBS_Bottom Third	0.250	0.225	0.306	0.273	0.313
TBS Percentile	57.453	59.894	52.759	53.758	53.017

(Source: Author, 2006)

Table 72. Proportions and Sample Means for Ground Support Occupational Field – O-5 Promotion Model

Variable	GRDSUP	0202	0402	0602	1302
Promoted to O-5	0.616	0.560	0.641	0.574	0.602
Prior Enlisted	0.152	0.174	0.132	0.177	0.106
OCC	0.250	0.199	0.282	0.200	0.212
NROTC	0.210	0.261	0.183	0.203	0.329
MECEP	0.032	0.066	0.023	0.055	0.012
ECP	0.056	0.071	0.044	0.064	0.012
USNA	0.094	0.104	0.086	0.099	0.124
Female	0.070	0.100	0.063	0.093	0
Comm_Age	23.285	23.415	23.214	23.287	22.770
Married	0.437	0.427	0.450	0.458	0.304
African American	0.068	0.021	0.069	0.078	0.019
Hispanic	0.026	0.046	0.112	0.026	0.031
Other Ethnic	0.030	0.037	0.163	0.029	0.025
TBS_Middle Third	0.319	0.290	0.475	0.316	0.335
TBS_Bottom Third	0.368	0.270	0.493	0.340	0.261
TBS Percentile	47.374	55.528	42.697	49.578	54.884

Variable	3002	5803
Promoted to O-5	0.634	0.651
Prior Enlisted	0.147	0.270
OCC	0.336	0.315
NROTC	0.155	0.127
MECEP	0.004	0
ECP	0.056	0.175
USNA	0.086	0.032
Female	0.095	0.063
Comm_Age	23.474	24.254
Married	0.487	0.460
African American	0.125	0.111
Hispanic	0.030	0.016
Other Ethnic	0.034	0.016
TBS_Middle Third	0.310	0.317
TBS_Bottom Third	0.478	0.333
TBS Percentile	39.554	51.668

(Source: Author, 2006)

Table 73. Proportions and Sample Means for Service Support Occupational Field – O-5 Promotion Model

Variable	SERSUP	0180	3404	4302	4402
Promoted to O-5	0.691	0.670	0.645	0.483	0.719
Prior Enlisted	0.127	0.297	0.172	0.276	0.035
OCC	0.277	0.374	0.269	0.414	0.212
NROTC	0.154	0.121	0.226	0.103	0.131
MECEP	0.035	0.077	0.065	0.069	0.004
ECP	0.037	0.110	0.065	0.069	0
USNA	0.068	0.066	0.075	0.069	0.065
Female	0.180	0.451	0.247	0.276	0.042
Comm_Age	23.676	24.253	23.419	23.448	23.592
Married	0.445	0.626	0.505	0.414	0.373
African American	0.055	0.099	0.108	0.034	0.019
Hispanic	0.029	0.033	0.022	0	0.031
Other Ethnic	0.025	0.055	0.022	0.034	0.015
TBS_Middle Third	0.367	0.374	0.355	0.586	0.342
TBS_Bottom Third	0.322	0.418	0.344	0.310	0.281
TBS Percentile	49.416	40.845	46.477	41.224	54.542

(Source: Author, 2006)

Table 74. Proportions and Sample Means for Aviation Fixed Wing Occupational Field – O-5 Promotion Model

Variable	AVFIXED	7509	7523	7543	7557
Promoted to O-5	0.667	0.646	0.735	0.690	0.570
Prior Enlisted	0.080	0.094	0.073	0	0.075
OCC	0.171	0.221	0.141	0.103	0.269
NROTC	0.168	0.144	0.192	0.138	0.075
MECEP	0.007	0	0	0	0
ECP	0.025	0.028	0.021	0	0.032
USNA	0.175	0.099	0.184	0.103	0.075
Female	0	0	0	0	0
Comm_Age	22.709	22.834	22.423	22.138	23.376
Married	0.380	0.420	0.359	0.172	0.419
African American	0.014	0.006	0.009	0	0.065
Hispanic	0.016	0.006	0.004	0	0.043
Other Ethnic	0.013	0.006	0.013	0	0.022
TBS_Middle Third	0.324	0.337	0.329	0.448	0.387
TBS_Bottom Third	0.158	0.155	0.128	0.241	0.290
TBS Percentile	64.078	64.273	66.909	54.120	52.884

(Source: Author, 2006)

Table 75. Proportions and Sample Means by PMOS for Aviation Rotary Wing Group

Variable	ROTARY	7562	7563	7564	7565	7566
Promoted to O-5	0.636	0.641	0.623	0.686	0.684	0.565
Prior Enlisted	0.072	0.058	0.077	0.049	0.086	0.094
OCC	0.201	0.194	0.192	0.225	0.176	0.230
NROTC	0.165	0.167	0.185	0.108	0.209	0.131
MECEP	0.009	0.007	0	0.010	0.011	0.016
ECP	0.017	0.017	0.031	0.010	0.011	0.016
USNA	0.115	0.155	0.062	0.118	0.064	0.110
Female	0	0	0	0	0	0
Comm_Age	22.882	22.891	22.869	22.892	22.770	22.942
Married	0.397	0.381	0.431	0.461	0.353	0.414
African American	0.018	0.010	0.008	0.049	0.011	0.031
Hispanic	0.024	0.022	0.031	0.020	0.021	0.026
Other Ethnic	0.024	0.010	0.062	0.029	0.032	0.016
TBS_Middle Third	0.360	0.352	0.408	0.343	0.316	0.408
TBS_Bottom Third	0.288	0.277	0.208	0.451	0.225	0.340
TBS Percentile	52.528	53.281	56.185	42.662	58.955	47.098

(Source: Author, 2006)

Table 76. Proportions and Sample Means by PMOS for Aviation Support Group

Variable	AVSUP	6002	6602	7202
Promoted to O-5	0.688	0.687	0.725	0.592
Prior Enlisted	0.186	0.229	0.159	0.245
OCC	0.228	0.253	0.290	0.143
NROTC	0.186	0.084	0.203	0.204
MECEP	0.036	0.048	0.058	0.020
ECP	0.094	0.120	0.029	0.163
USNA	0.092	0.120	0.145	0.061
Female	0.056	0.108	0.072	0
Comm_Age	23.68	24.217	23.42	23.612
Married	0.501	0.494	0.565	0.367
African American	0.039	0.060	0.058	0.020
Hispanic	0.024	0.012	0	0.020
Other Ethnic	0.022	0.036	0.029	0
TBS_Middle Third	0.339	0.313	0.304	0.408
TBS_Bottom Third	0.269	0.241	0.304	0.265
TBS Percentile	53.543	55.358	51.711	51.486

(Source: Author, 2006)

4. Logistic Regression Estimates for O-5 Promotion Model

The classification table results shown in Table 77, predicts the accuracy of the logistic regression model where the observed values for the dependent outcome and the

predicted values are cross classified at a cut off value where p = 0.65. The O-5 promotion model correctly predicts 67.6% of the O-5 promotion decisions. The Likelihood Ratio, Score, and Wald statistics which test the global null hypothesis that all Betas = 0 are significant at the 1% level. Therefore, at least one on the Betas is not equal to zero and the global null hypothesis is rejected.

A list of variables used in the logistic regression models and their coefficients, standard errors, chi-squared values, partial effects and odds ratios are shown in Tables 78 and 79. The results of the logistic regression model for O-5 promotions show that six out of twenty-nine PMOSs were significant in determining whether an officer is promoted to O-5, when compared to the base case (infantry officer).

Table 77. Classification Table for the O-5 Promotion Model

Observed		Predicted		Percentage Correct
		Promote O-5 = 0	Promote O-5 = 1	
Promote O-5 = 0	1,981	1,016	895	51.3
Promote O-5 = 1	3,756	965	2,861	76.2
Prob Level	.65			
Overall Percentage				67.6

(Source: Author, 2006)

Table 78. Logistic Estimates for the O-5 Promotion Model with PMOS

Variable	Coefficient	Std Error	Chi-Square	Partial Effect	Odds Ratio
Intercept	2.452	0.458	28.619	0.000	
Married	-0.076	0.068	1.271	-0.014	0.927
Comm_Age	-0.071 ***	0.020	12.869	-0.013	0.932
Female	0.436 **	0.182	5.768	0.068	1.546
African American	-0.018	0.151	0.014	-0.003	0.982
Hispanic	0.169	0.201	0.709	0.029	1.185
Other Ethnic Group	0.008	0.198	0.002	0.001	1.008
TBS Percentile	0.008 ***	0.001	47.058	0.001	1.008
Prior Enlisted	-0.170	0.149	1.295	-0.032	0.844
NROTC	-0.241 ***	0.084	8.123	-0.045	0.786
USNA	-0.075	0.106	0.501	-0.014	0.928
OCC	0.212 **	0.093	5.233	0.036	1.236

Variable	Coefficient	Std Error	Chi-Square	Partial Effect	Odds Ratio
MECEP	-0.921 ***	0.249	13.716	-0.199	0.398
ECP	-0.320	0.213	2.252	-0.062	0.726
Adjutant	0.108	0.271	0.159	0.019	1.114
Intelligence	-0.447 ***	0.159	7.932	-0.088	0.640
Logistics	-0.124	0.125	0.983	-0.023	0.883
Communications	-0.124	0.125	0.983	-0.086	0.647
Artillery	-0.007	0.132	0.003	-0.001	0.993
Engineer	-0.354 *	0.185	3.638	-0.069	0.702
Tank	-0.168	0.224	0.560	-0.031	0.846
AAV	-0.309	0.276	2.008	-0.076	0.677
Supply	-0.119	0.166	0.509	-0.022	0.888
Finance	-0.241	0.243	0.982	-0.046	0.786
Public Affairs	-0.859 **	0.411	4.368	-0.184	0.424
Judge Advocate	0.165	0.166	0.992	0.028	1.179
MP	-0.070	0.290	0.058	-0.013	0.932
Aircraft Maintenance	0.063	0.262	0.058	0.011	1.065
Aviation Supply	0.253	0.300	0.710	0.042	0.843
LAAD	0.293	0.341	0.735	0.048	1.287
Air Support Control	-0.140	0.292	0.231	-0.026	1.340
Air Defense Control	0.624 *	0.321	3.795	0.092	0.869
AV8B	-0.200	0.182	1.219	-0.037	0.818
FA18	0.293 *	0.177	2.737	0.048	1.341
EA6B	0.088	0.442	0.040	0.015	1.092
C130	-0.365	0.664	0.302	-0.071	0.694
CH46	-0.141	0.131	1.154	-0.026	0.869
UH1	-0.173	0.213	0.663	-0.032	0.841
CH53A_D	-0.019	0.237	0.006	-0.003	0.981
AH1	0.099	0.187	0.282	0.017	1.104
CH53E	-0.309 *	0.177	3.070	-0.060	0.734
A6E	0.587	0.774	0.575	0.088	1.799
EA6B Electronic	-0.344	0.243	1.992	-0.066	0.709
FY 81	0.078	0.150	0.268	0.013	1.081
FY 82	-0.141	0.144	0.962	-0.026	0.868
FY 83	0.189	0.141	1.803	0.032	1.208
FY 84	-0.158	0.147	1.160	-0.029	0.853
FY 85	-0.128	0.148	0.755	-0.024	0.880
FY 86	-0.120	0.145	0.690	-0.022	0.887
FY 87	-0.206	0.144	2.060	-0.039	0.814
FY 88	-0.587 ***	0.142	17.173	-0.120	0.556
FY 89	-2.300 ***	0.147	243.971	-0.519	0.100

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

The partial effect value describes the percentage change in the predicted probability for a base case officer with average values for continuous variables and binary variables equal to zero. The partial effect estimate which explains whether an officer is more or less likely to be promoted to O-5, than the base case, depending on the sign, is used to compare officers in different PMOSs or occupational fields to an average base case officer. (Here a positive sign means more likely, and a negative sign means less likely, than the base case to be promoted to O-5). The base case is a single white male who was non-prior service, who was commissioned through PLC, finished in the top third at TBS, held an 0302 (Infantry) PMOS, and was commissioned in FY 1980.

The results of the logistic regression model show the following focus variables as being significant when analyzing O-5 promotions: intelligence, engineer, public affairs, air defense control, F/A 18 pilots, and CH 53E pilots. The Intelligence PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an intelligence officer who has all the other base-case attributes is 8.84% less likely to be promoted to O-5 than an officer whose attributes are entirely those of the base case. The odds of any intelligence officer being promoted to O-5 are 0.640 times (that is, 36% less than) the odds of an infantry officer with otherwise identical attributes.

The Public Affairs PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, a public affairs officer who has all the other base-case attributes is 18.44% less likely to be promoted to O-5 than an officer whose attributes are entirely those of the base case. The odds of any public affairs officer being promoted to O-5 are 0.424 times (that is, 57.6% less than) the odds of an infantry officer with otherwise identical attributes. The CH53_E PMOS has a negative coefficient and the coefficient is significant at the 1% level. According to the model, a CH53_E pilot who has all the other base-case attributes is 5.99% less likely to be promoted to O-5 than an officer whose attributes are entirely those of the base case. The odds of any CH53_E pilot being promoted to O-5 are 0.734 times (that is, 26.6% less than) the odds of an infantry officer with otherwise identical attributes.

The higher the percentile in which an officer graduates TBS is positively associated with the likelihood of being promoted to O-5 and the results are significant at

the 1% level. The odds ratio of 1.008 for TBS class standing percentile says that under the model, each one-percent increase in class standing is associated with 0.8% increase in the predicted odds of being promoted to O-5.

Table 79. Logistic Estimates for the O-5 Promotion Model with Occupational Fields

Variable	Coefficient	Standard Error	Chi-Square	Partial Effect	Odds Ratio
Intercept	2.420	0.4523	28.638	0.000	
Married	-0.078	0.067	1.347	-0.014	0.925
Comm_Age	-0.069 ***	0.020	12.639	-0.013	0.933
Female	0.401 ***	0.174	5.284	0.063	1.493
African American	-0.0004	0.150	0	0	1.000
Hispanic	0.160	0.199	0.644	0.027	1.173
Other Ethnic Group	-0.020	0.196	0.011	-0.004	0.980
TBS Percentile	0.008 ***	0.001	49.785	0.001	1.008
Prior Enlisted	-0.176	0.148	1.400	-0.033	0.839
NROTC	-0.258 ***	0.084	9.453	-0.049	0.773
USNA	-0.085	0.105	0.656	-0.015	0.918
OCC	0.207	0.092	5.020	0.035	1.230
MECEP	-0.974 ***	0.247	15.579	-0.212	0.378
ECP	-0.352	0.212	2.757	-0.068	0.703
Ground Support	-0.249 ***	0.081	9.477	-0.047	0.779
Service Support	0.042	0.116	0.130	0.007	1.043
Aviation Fixed Wing	-0.035	0.104	0.111	-0.006	0.966
Aviation Rotary Wing	-0.109	0.093	1.382	-0.020	0.896
Aviation Support	0.164	0.129	1.608	0.028	1.517
FY 81	0.069	0.149	2.757	0.012	1.071
FY 82	-0.146	0.143	0.215	-0.027	0.864
FY 83	0.175	0.140	1.041	0.030	1.191
FY 84	-0.148	0.146	1.567	-0.027	0.862
FY 85	-0.132	0.147	1.031	-0.024	0.876
FY 86	-0.137	0.144	0.815	-0.025	0.872
FY 87	-0.206	0.143	0.908	-0.039	0.814
FY 88	-0.612 ***	0.141	2.094	-0.125	0.542
FY 89	-2.291 ***	0.146	18.988	-0.517	0.101

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

Table 79 shows that only one occupational field significantly affects promotion to O-5. The results of the logistic regression model, when occupational fields are the focus variables, show that the ground support occupational field has a negative coefficient and the coefficient is significant at the 1% level. According to the model, an officer in the ground support occupational field that has all the other base-case attributes is 4.7% less

likely to be promoted to O-5 than an officer whose attributes are entirely those of the base case. The odds of any ground support officer being promoted to O-5 are 0.779 times (that is, 22.1% less than) the odds of an officer in the combat arms occupational field with otherwise identical attributes.

A female officer who has all the other base-case attributes is 6.3% more likely to be promoted to O-5 than an officer whose attributes are entirely those of the base case. The odds of a female officer being promoted to O-5 are 1.493 times (that is, 49.3% more than) the odds of a male officer with otherwise identical attributes. Officers commissioned through MECEP who has all the other base-case attributes is 21.17% less likely to be promoted to O-5 than an officer whose attributes are entirely those of the base case. The odds of an officer commissioned through MECEP being promoted to O-5 are 0.378 times (that is, 62.2% less than) the odds of an officer commissioned through PLC with otherwise identical attributes.

5. PROC LIFETEST Results for the O-5 Promotion Model

The Kaplan-Meier method was used in the O-5 promotion models to test whether the promotion functions were identical for different occupational fields or PMOSs. The LIFETEST procedure examined 8,334 officers of which 3,752 observations were censored. Table 80 gives the quartile point estimates, where the probability of being promoted to O-5 being greater than .75 occurs at 264 months of commissioned service. The point estimate for the 50% quartile is 246 months and the 95% confidence interval gives lower and upper ranges of 244 and 247 respectively.

Table 80. PROC LIFETEST Procedure with Kaplan-Meier Summary Statistics – O-5 Promotion Model

		95% Confidence Interval	
%	Point Estimate	Lower	Upper
75	264	264	268
50	246	244	247
19625	222	221	223

(Source: Author, 2006)

Figure 22 illustrates the different promotion functions for the six occupational fields, where each occupational field has a separate promotion function depicted by one of six different colors. Figure 22 shows that officers in the aviation fixed wing occupational field are promoted slightly faster to O-5.

Table 81 presents the summary of the number of censored and uncensored values and the rank statistics for the six occupational groups. Table 82 shows that the Test of Equality over Strata and the results of the Log-rank and Wilcoxon tests are significant for occupational groupings (the p-values for both tests, given in the Pr > chi-square column, are <.0001). The null hypothesis that there is no difference in promotion patterns among the different occupational fields is rejected. Therefore, the O-5 promotion patterns of officers in different occupational fields are not identical. Table 83 shows that the Test of Equality over Strata and the results of the Log-rank (the p-value, given in the Pr > chi-square column, is 0.0002) and Wilcoxon tests (the p-value, given in the Pr > chi-square column, is 0.0007), therefore both tests are significant. Table 83 shows the test results for homogeneity for different PMOSs. The null hypothesis that there is no difference in promotion patterns among the different PMOSs is rejected and their promotion patterns are therefore not identical.

Table 81. Summary of Censored and Uncensored Values with Tests Statistics – O-5 Promotion Model

Source	Total	Failed	Censored	Percent Censored	Log-Rank	Wilcoxon
Combat Arms	2,123	1,056	1,067	50.26	-89.019	-171070
Ground Support	2,213	925	1,288	58.20	-28.258	-160267
Service Support	682	324	358	52.49	27.668	116635
Aviation Fixed	1,227	503	724	59.01	37.662	96817
Aviation Rotary	1,496	651	845	56.48	4.110	6806
Aviation Support	593	293	300	50.59	47.837	111079

(Source: Author, 2006)

Table 82. Testing Homogeneity of O-5 Promotion Patterns for the Different Occ Fields

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	24.176	5	0.0002
Wilcoxon	21.394	5	0.0007
-2Log (LR)	16.191	5	0.0063

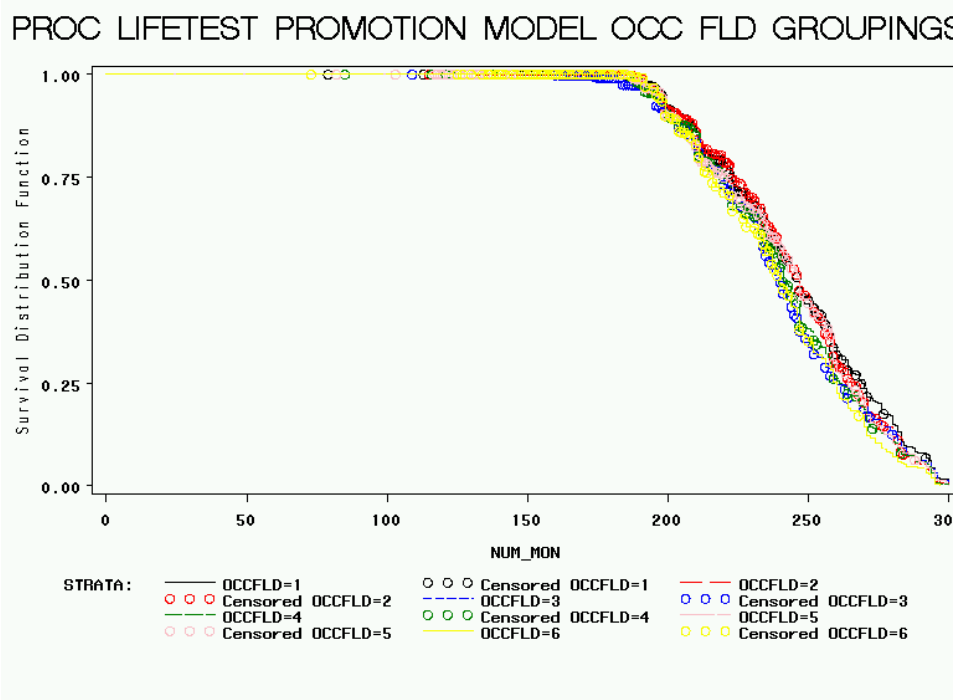
(Source: Author, 2006)

Table 83. Testing Homogeneity of O-5 Promotion Patterns for the Different PMOSs

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	98.729	40	<.0001
Wilcoxon	82.782	40	<.0001
-2Log (LR)	81.853	40	0.0001

(Source: Author, 2006)

Figure 22. Graph of PROC LIFETEST with Occupational Field Groupings - O-5 Promotion Model



Occupational Field 1 – Combat Arms: black
Occupational Field 2 – Ground Support: red
Occupational Field 3 – Service Support: blue
Occupational Field 4 – Aviation Fixed Wing: green
Occupational Field 5 – Aviation Rotary Wing: pink
Occupational Field 6 – Aviation Support: yellow
(Source: Author, 2006)

Appendix B shows LIFETEST graphs for each occupational field and a selected PMOS within each of the six occupational fields for O-5 promotions. Table 84 shows the test results for homogeneity for officers in the service support occupational field. Table 85 shows the test results for homogeneity for FA18 pilots. In all three cases the null hypothesis is rejected, therefore the promotion patterns are not identical. Figure 23 displays the promotion patterns for service support officers. Figure 24 displays the promotion patterns of FA18 pilots.

Table 84. Testing Homogeneity of O-5 Promotion Patterns for Service Support Occ Field

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	4.8142	1	0.0282
Wilcoxon	7.0054	1	0.0081
-2Log (LR)	0.6773	1	0.4105

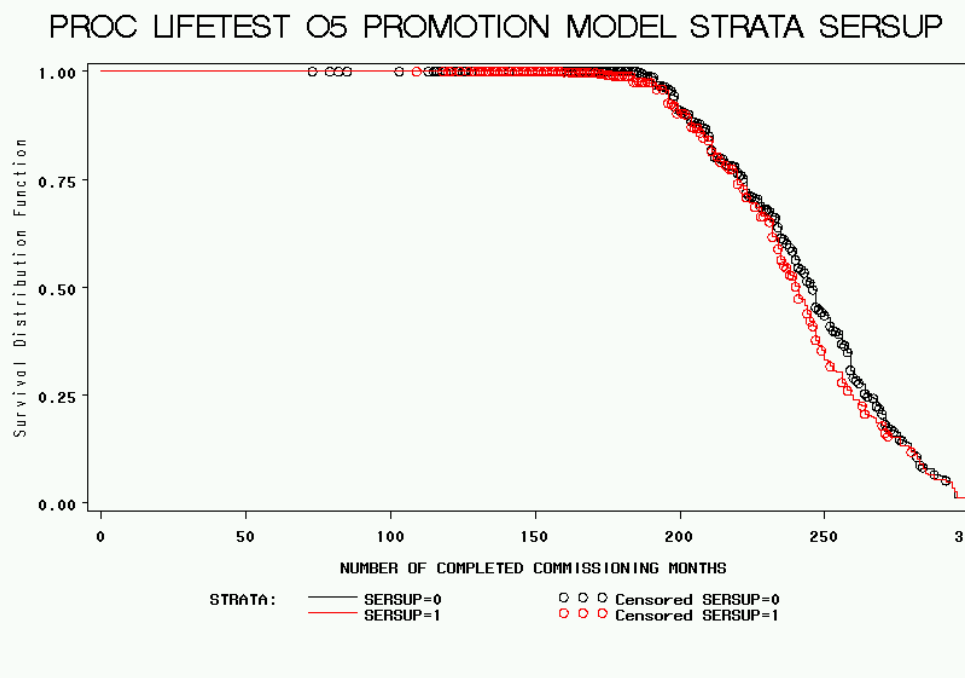
(Source: Author, 2006)

Table 85. Testing Homogeneity of O-5 Promotion Patterns for the FA18 Pilots

Test	Chi-Square	DF	Pr > Chi-Square
Log – Rank	2.7124	1	0.0996
Wilcoxon	4.1524	1	0.0416
-2Log (LR)	0.0060	1	0.9384

(Source: Author, 2006)

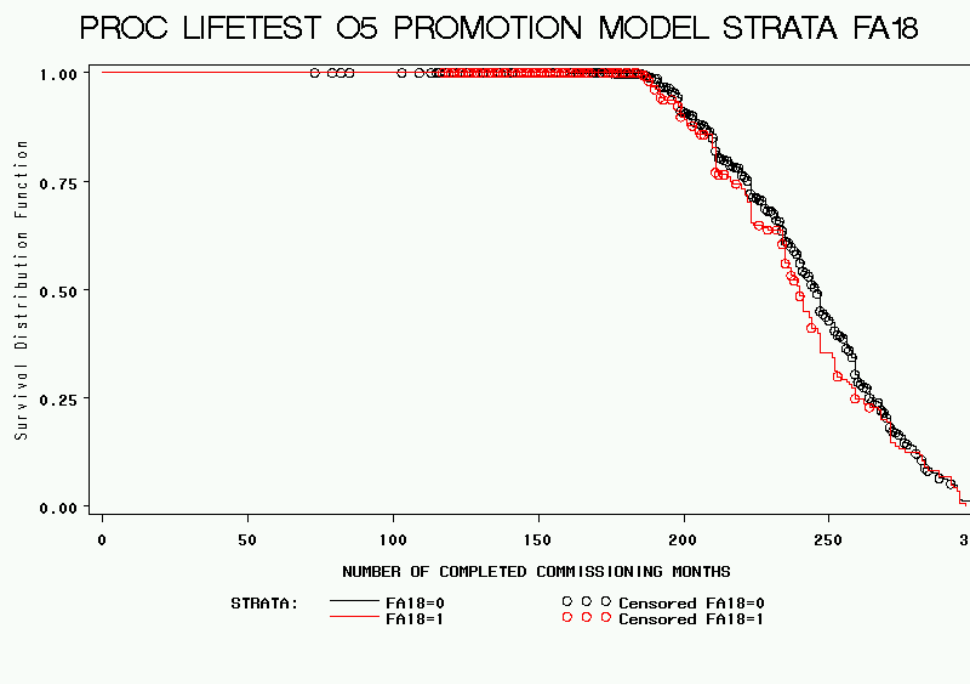
Figure 23. Graph of PROC LIFETEST for Service Support Occupational Field – O-5 Promotion Model



Service Support = 0 (Black) Service Support = 1 (Red)

(Source: Author, 2006)

Figure 24. Graph of PROC LIFETEST for FA18 Pilots



F/A18 Pilots = 0 (Black) F/A Pilots = 1 (Red)
(Source: Author, 2006)

Figure 23 shows officers who survived until the O-5 promotion board and are either service support or non-service support. Officers in service support are promoted faster. Figure 24 shows officers who survived until the O-5 promotion board and are F/A 18 pilots or non-F/A 18 pilots. Officers who fly F/A 18s are promoted slightly faster.

6. Cox Regression Estimates for the O-5 Promotion Model

The number of observations used in the PHREG procedure was 5,737 where 1,981 values were censored. Table 86 shows the results of the global null hypothesis: Beta = 0 when PMOSs are included in the model. The results of each test are significant and the null hypothesis is rejected. Table 87 shows the parameter estimates, standard errors, chi-squared values and hazard ratios for the variables used in the Cox regression model used to analyze O-5 promotion patterns.

The significant variables in the Cox regression model include married, female, African American and each fiscal year. The estimated risk for married officers is 93.7% of the hazard for those who are single (controlling other covariates). Therefore, the hazard of being passed over for promotion to O-5 for married officers goes down by an estimated 6.3%, compared to the O-4 hazard of 16.9%. The estimated risk for female

officers is 135.6% of the hazard for those who are male (controlling other covariates). Therefore, the hazard of being passed over for promotion to O-5 for female officers goes up by an estimated 35.6%.

The significant focus variables include: tank and judge advocate. The estimated risk for judge advocate officers is 125.2% of the hazard for those who are in the base case (controlling other covariates). Therefore, the hazard of being passed over for promotion to O-5 for judge advocate officers goes up by an estimated 25.2%, compared to the O-4 hazard of 15.1%. The estimated risk for tank officers is 79.5% of the hazard for those who are non-tank officers (controlling other covariates). Therefore, the hazard of being passed over for promotion to O-5 for tank officers goes down by an estimated 20.5%.

Table 86. Test Results for the Global Null Hypothesis: PROC PHREG by PMOS – O-5 Promotion Model

Test	Chi-Square	DF	Pr > Chi-Square
Likelihood Ratio	8446.964	52	<.0001
Score	9824.079	52	<.0001
Wald	3684.101	52	<.0001

(Source: Author, 2006)

Table 87. Analysis of Maximum Likelihood Estimates for PROC PHREG by PMOS – O-5 Promotion Model

Variable	**Parameter Estimate**	**Standard Error**	**Chi-Square**	**Hazard Ratio**
Married	-0.065 *	0.036	3.242	0.937
Comm_Age	-0.012	0.011	1.188	0.988
Female	0.305 ***	0.094	10.460	1.356
African American	-0.152 *	0.089	2.870	0.859
Hispanic	0.044	0.114	0.151	1.045
Other Ethnic Group	0.026	0.113	0.055	1.027
TBS Percentile	0.0008	0.001	1.831	1.001
Prior Enlisted	-0.041	0.098	0.173	0.960
NROTC	-0.073	0.047	2.456	0.930
USNA	0.048	0.057	0.706	1.049
OCC	-0.025	0.049	0.258	0.975
MECEP	0.120	0.173	0.477	1.127
ECP	0.041	0.134	0.093	1.042
Adjutant	-0.157	0.143	1.209	0.855
Intelligence	-0.030	0.094	0.102	0.970
Logistics	0.008	0.068	0.013	1.008
Communications	-0.038	0.080	0.224	0.963
Artillery	-0.097	0.070	1.935	0.908

Variable	Parameter Estimate	Standard Error	Chi-Square	Hazard Ratio
Engineer	-0.066	0.108	0.370	0.937
Tank	-0.229*	0.122	3.501	0.795
AAV	-0.051	0.163	0.098	0.950
Supply	-0.128	0.091	1.952	0.880
Finance	0.077	0.136	0.320	1.080
Public Affairs	0.173	0.275	0.394	1.188
Judge Advocate	0.224 ***	0.082	7.521	1.252
MP	0.187	0.161	1.351	1.206
Aircraft Maintenance	0.162	0.138	1.366	1.175
Aviation Supply	-0.025	0.147	0.028	0.976
LAAD	0.028	0.159	0.032	1.029
Air Support Control	0.042	0.169	0.062	1.043
Air Defense Control	0.055	0.141	0.154	1.057
Air Traffic Control	0.196	0.461	0.181	1.216
AV8B	-0.139	0.099	1.968	0.870
FA18	0.051	0.084	0.362	1.052
EA6B	0.133	0.225	0.342	1.142
C130	0.137	0.381	0.128	1.146
CH46	-0.113	0.071	2.489	0.894
UH1	-0.107	0.117	0.837	0.898
CH53A_D	-0.100	0.125	0.634	0.905
AH1	-0.088	0.096	0.840	0.916
CH53E	-0.122	0.103	1.391	0.885
A6E	0.330	0.293	1.270	1.391
EA6B_Electronic	-0.147	0.142	1.060	0.864
FY 81	1.128 ***	0.098	133.182	3.088
FY 82	1.975 ***	0.110	320.586	7.210
FY 83	2.977 ***	0.116	653.002	19.624
FY 84	3.977 ***	0.129	955.691	53.382
FY 85	5.790 ***	0.143	1638.300	326.846
FY 86	7.952 ***	0.172	2144.760	2840.080
FY 87	10.439 ***	0.204	2615.460	34159.170
FY 88	13.047 ***	0.241	2927.120	463546.500
FY 89	16.738 ***	0.362	2132.160	18592486.000

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.
(Source: Author, 2006)

Table 88 shows the results of the global null hypothesis: Beta = 0 when occupational fields are included in the model. The results of each test are significant and the null hypothesis is rejected. Table 89 shows the parameter estimates, standard errors, chi-squared values and hazard ratios for the variables used in the Cox regression model used to analyze O-5 promotion patterns when occupational fields are included. The only

significant focus variable is service support. The estimated risk for service support officers is 118.9% of the hazard for those who are in the combat arms occupational field (controlling other covariates). Therefore, the hazard of being passed over for promotion to O-5 for service support officers goes up by an estimated 18.9%. The estimated risk for an African American officer is 85.3% of the hazard for those who are white (controlling other covariates). Therefore, the hazard of being passed over for promotion to O-5 for African American officers goes down by an estimated 14.7%.

Table 88. Test Results for the Global Null Hypothesis: PROC PHREG by Occ Field – O-5 Promotion Model

Test	Chi-Square	DF	Pr > Chi-Square
Likelihood Ratio	8427.289	27	<.0001
Score	9808.408	27	<.0001
Wald	3673.851	27	<.0001

(Source: Author, 2006)

Table 89. Analysis of Maximum Likelihood Estimates for PROC PHREG by Occ Field – O-5 Promotion Model

Variable	**Parameter Estimate**	**Standard Error**	**Chi-Square**	**Hazard Ratio**
Married	-0.078 **	0.036	4.698	0.925
Comm_Age	-0.020	0.011	1.162	0.988
Female	0.240 ***	0.088	7.456	1.271
African American	-0.159 *	0.089	3.203	0.853
Hispanic	0.036	0.114	0.100	1.037
Other Ethnic Group	0.017	0.112	0.022	1.017
TBS Percentile	0.001 *	0.001	2.979	1.001
Prior Enlisted	-0.052	0.097	0.285	0.949
NROTC	-0.077 *	0.046	2.761	0.926
USNA	0.050	0.057	0.784	1.051
OCC	-0.027	0.049	0.311	0.973
MECEP	0.107	0.172	0.384	1.113
ECP	0.040	0.134	0.089	1.041
Ground Support	0.010	0.045	0.048	1.010
Service Support	0.173 ***	0.062	7.804	1.189
Aviation Fixed Wing	-0.004	0.055	0.005	0.996
Aviation Rotary Wing	-0.068	0.050	1.815	0.934
Aviation Support	0.099	0.067	2.174	1.103
FY 81	1.126 ***	0.097	133.611	3.082
FY 82	1.961 ***	0.110	317.662	7.103
FY 83	2.958 ***	0.116	648.685	19.262
FY 84	3.968 ***	0.128	955.927	52.859
FY 85	5.768 ***	0.143	1637.593	320.027

Variable	Parameter Estimate	Standard Error	Chi-Square	Hazard Ratio
FY 86	7.921 ***	0.171	2143.092	2753.916
FY 87	10.409 ***	0.203	2616.544	33149.520
FY 88	13.009 ***	0.240	2926.103	446239.500
FY 89	16.700 ***	0.362	2122.818	17896547.000

* Significant at 0.10 level, ** Significant at 0.05 level, *** Significant at 0.01 level.

(Source: Author, 2006)

D. REQUIREMENTS AND CRITICALLY SHORT PMOS'S

The requirements listed on the GAR report were used along with the average on board strength to determine the GAR percentage pre-board. The USMC Major, Lieutenant Colonel, and Colonel Selection Board results were used to identify the number of officers, by PMOS, selected for promotion to O-4 through O-6. The number of officers selected for promotion to O-4 or O-5 was added to the average on-board number and the number of officers selected for O-5 or O-6 for that particular PMOS was subtracted. The final number was used to determine the GAR percentage post-board. The number of times that a particular PMOS was below 85%, either pre- or post board are shown in Table 90 for O-4 promotions and Table 91 for O-5 promotions. In both tables combat arms and aviation rotary wing pilots were usually above 85%, where ground support and service support PMOSs were consistently below 85%.

A comparison of on-board strengths of infantry officers compared to the pre- and post-board GAR percentages are shown in Figures 25 and 26. Both figures show that infantry officers, during 1990 – 2005, were always over 100% of the GAR. Figures 27 and 28 show the differences between promotion averages and promotion rates for PMOSs listed as critically short. Figure 27 shows that PMOSs listed as critically short have generally done better than the board average, 12 out of 16 fiscal years, when looking at promotion to O-4. However, Figure 28 shows that PMOSs listed as critically short have generally done worse than the board average, 4 out of 16, when looking at promotion to O-5. Appendix E compares critically short PMOSs, those PMOSs not listed as critically short and board averages for fiscal years 1990 – 2005.

Table 90. O-4 - Pre and Post Board Analysis of the GAR

		FY 1990 – FY 2005		FY 2001 – FY 2005	
	PMOS	**< 85% of the GAR Pre-Board**	**< 85% of the GAR Post-Board**	**< 85% of the GAR Pre-Board**	**< 85% of the GAR Post-Board**
Combat Arms	0302	0	0	0	0
	0802	1	1	0	0
	1802	0	0	0	0
	1803	3	2	0	0
Ground Support	0202	14	13	5	5
	0402	6	3	0	0
	0602	13	8	5	2
	1302	8	6	2	0
	3002	6	2	2	2
	5803	10	7	1	1
Service Support	0180	9	8	5	5
	3404	7	5	2	2
	4302	9	7	0	0
	4402	1	0	0	0
Aviation Fixed Wing	7509	4	4	0	0
	7523	1	1	0	0
	7543	5	6	0	0
	7557	11	10	1	0
Aviation Rotary Wing	7562	0	0	0	0
	7563	0	0	0	0
	7564	3	2	0	0
	7565	3	3	0	0
	7566	0	0	0	0
Aviation Support	6002	3	1	0	0
	6602	10	6	5	3
	7202	8	6	4	3

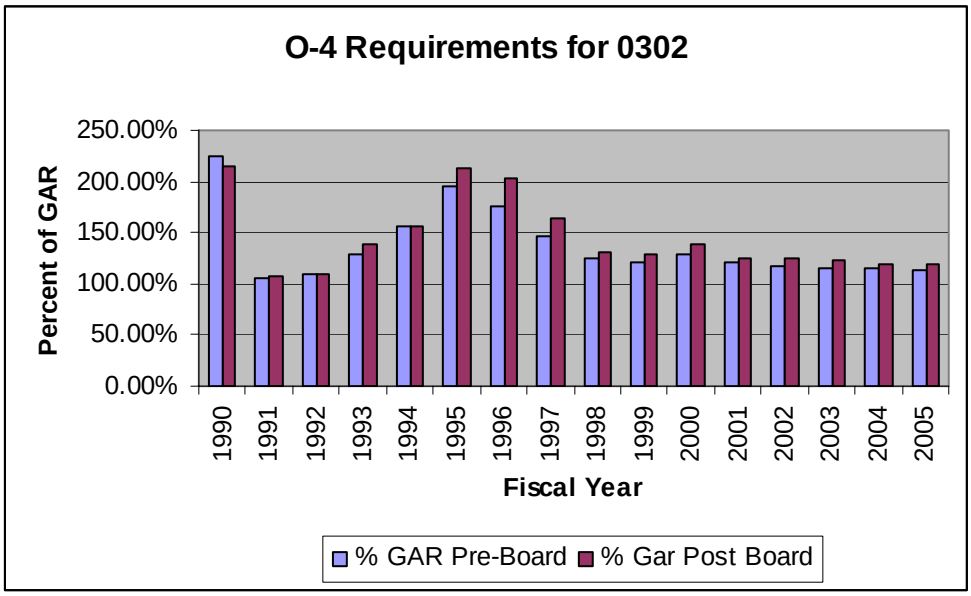
(Source: Author, 2006)

Table 91. O-5 - Pre and Post Board Analysis of the GAR

		FY 1990 – FY 2005		FY 2001 – FY 2005	
	PMOS	**< 85% of the GAR Pre-Board**	**< 85% of the GAR Post-Board**	**< 85% of the GAR Pre-Board**	**< 85% of the GAR Post-Board**
Combat Arms	0302	0	0	0	0
	0802	1	0	0	0
	1802	0	0	0	0
	1803	1	0	0	0
Ground Support	0202	14	11	5	5
	0402	9	9	0	0
	0602	11	9	3	1
	1302	14	10	5	4
	3002	5	2	0	0
	5803	8	4	0	0
Service Support	0180	5	3	4	3
	3404	15	11	5	4
	4302	15	14	5	5
	4402	2	0	0	0
Aviation Fixed Wing	7509	8	3	0	0
	7523	0	0	0	0
	7543	7	6	0	0
	7557	13	12	5	5
Aviation Rotary Wing	7562	0	0	0	0
	7563	0	0	0	0
	7564	3	2	2	1
	7565	0	0	0	0
	7566	0	0	0	0
Aviation Support	6002	13	9	4	3
	6602	3	3	0	0
	7202	3	2	0	0

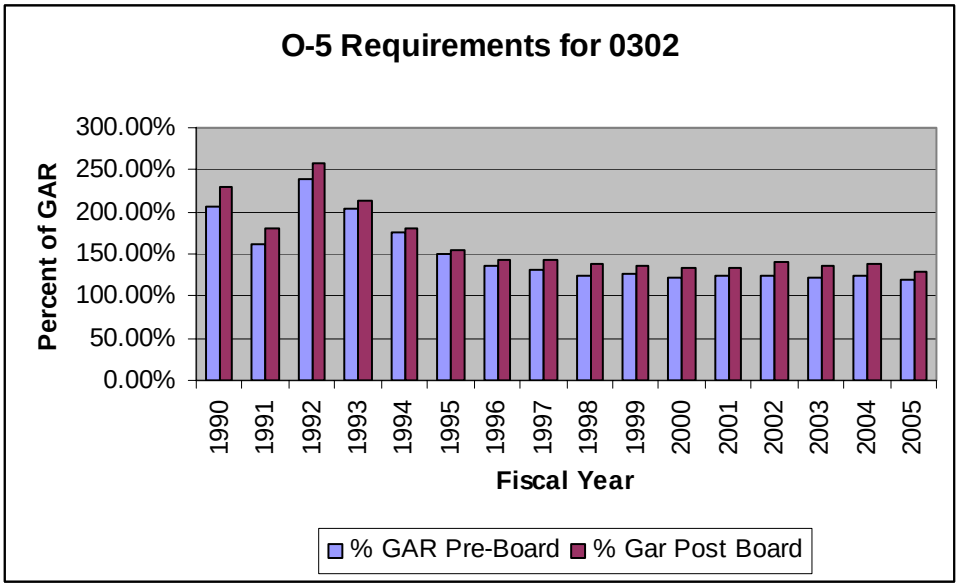
(Source: Author, 2006)

Figure 25. O-4 Requirements for Infantry - 0302



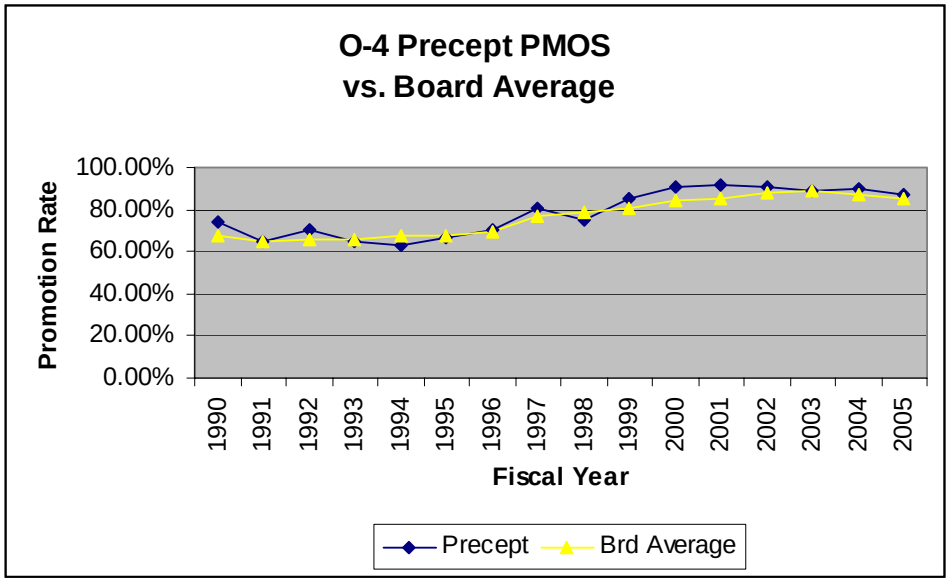
(Source: Author, 2006)

Figure 26. O-5 Requirements for Infantry - 0302



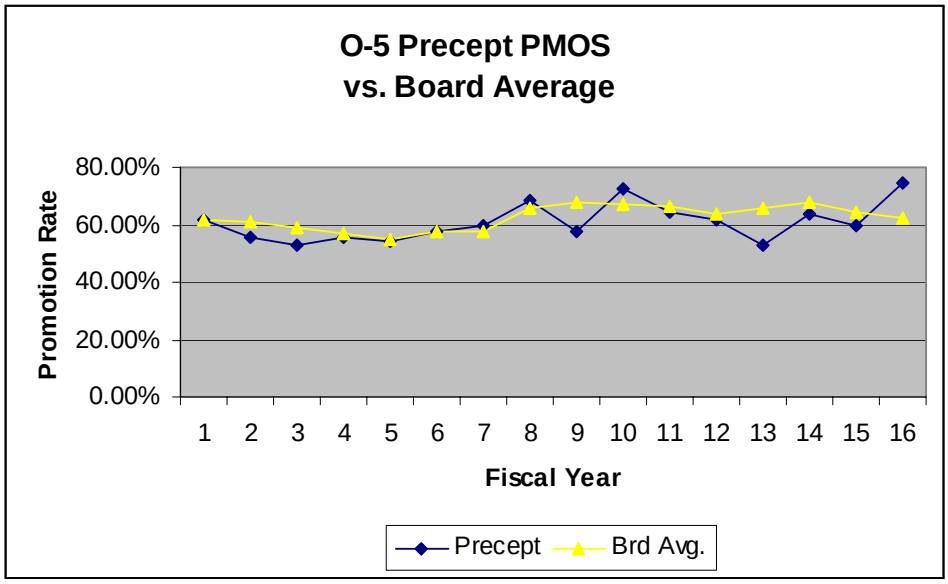
(Source: Author, 2006)

Figure 27. O-4 Precept PMOSs vs. Board Average



A precept PMOS is below 85% of the GAR (critical short PMOSs)
(Source: Author, 2006)

Figure 28. O-5 Precept PMOSs vs. Board Average



A precept PMOS is below 85% of the GAR (critical short PMOSs)
(Source: Author, 2006)

VI. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

> We make generals today on the basis of their ability to write a damned letter. Those kinds of men can't get us ready for war.
>
> *Lewis B. Puller: Marine, 1962*

A. SUMMARY AND CONCLUSIONS

This study attempts to identify and evaluate the effects of a Marine Corps officer's primary military occupational specialty on retention and promotion. In addition, this study analyzes other variables that affect retention and promotion such as demographics, commissioning sources, and performance at TBS. Chapter II describes the Human Resource Development Process (manning and staffing) and how the Marine Corps combines the capabilities of four interdependent commands to try to provide the appropriate number of trained and experienced Marines to units throughout the Corps in order to fulfill their mission. Chapter II also describes the officer promotion system and the process by which the best and most fully qualified officers are selected.

Chapter III reviews the literature on retention and promotion. Prior studies have focused on identifying and analyzing variables, other than PMOS, that significantly affect retention or promotion by focusing on the number of months until promotion or separation. Other studies have focused on identifying and analyzing variables, other than PMOS, at a particular juncture at which critical retention and promotion decisions are made. Most studies combine occupational fields in order to analyze the effects on the dependent variable, but limited research exists on the significance of individual PMOS.

The two data files used in the study are described in Chapter IV. The MCCOAC data file, created by CNA, is a longitudinal file in which event-based variables are recorded starting at the time of commissioning and continuing through separation. The MCCOAC data file contains 27,659 observations and provides the majority of the information used in the models. The Marine Officer Cohort data file, created by DMDC, was used strictly to verify information missing from the MCCOAC data file. Chapter IV describes the samples used in the 10 YCS Retention, O-4 Promotion, and O-5 Promotion models. Chapter IV also includes descriptions of the dependent and independent

variables used to estimate the retention and promotion models. The chi-square test of independence indicates that retention and promotion are not independent of an officer's PMOS or occupational field. Finally, Chapter IV revealed that certain PMOSs were constantly below 85% of the GAR requirement.

Chapter V includes multivariate model specifications, descriptions of the independent variables and their hypothesized effects on the dependent variable, and descriptive statistics. Chapter V also contains the logistic regression results for 10 YCS Retention, O-4 Promotion and O-5 Promotion models. In addition, Chapter V contains survival curves and results of tests of hypotheses about differences in survival functions of Marine officers in different PMOSs. Finally, Chapter V describes the results of the Cox Proportional Hazard procedure which show the effects of having a particular PMOS or occupational field on the hazards of separation and promotion.

The logistic regression results show that 94% of the PMOSs are significant in determining the likelihood of whether an officer stays until 10 YCS, when compared to an infantry officer. Having a Primary Military Occupational Specialty beginning with '75' (pilot) is positively correlated with whether an officer stays until 10 YCS, with two exceptions (EA6B and C130). A presumed contributing factor is the increased service obligation pilots incur after finishing flight school. Having one of the remaining PMOSs is negatively correlated with whether an officer stays until 10 YCS, when compared to an infantry officer. Having an aviation fixed- or rotary-wing occupational field is positively correlated with retention and having one of the remaining occupational fields is negatively correlated with whether an officer stays until 10 YCS. The survival functions among the different PMOSs and occupational fields are not identical; PMOSs or occupational fields are statistically significant in predicting whether an officer reaches 10 YCS. Tables 92 and 93 shows whether a PMOS or occupational field is positively or negatively associated with whether an officer survives until 10 YCS or the likelihood of whether an officer is selected to O-4 or O-5.

Table 92. Multivariate Regression Results for PMOSs

PMOS	10 YCS Retention	O-4 Promotion	O-5 Promotion
Adjutant	-	n.s.	n.s.
Intelligence	-	n.s.	-
Signals Intelligence	-	N/A	N/A
Logistics	-	+	n.s.
Communications	-	n.s.	n.s.
Artillery	-	n.s.	n.s.
Engineer	-	n.s.	-
Tank	-	n.s.	n.s.
AAV	-	n.s.	n.s.
Supply	-	n.s.	n.s.
Finance	-	n.s.	n.s.
Public Affairs	-	n.s.	-
Judge Advocate	-	n.s.	n.s.
MP	-	n.s.	n.s.
Aircraft Maintenance	-	n.s.	n.s.
Air Command / Control	-	n.s.	n.s.
Aviation Supply	-	n.s.	n.s.
LAAD	-	n.s.	n.s.
Air Support Control	-	n.s.	n.s.
Air Defense Control	-	n.s.	+
Air Traffic Control	-	n.s.	n.s.
AV8B	n.s.	-	n.s.
FA18	+	-	+
EA6B	-	-	n.s.
C130	-	-	n.s.
CH46	+	-	n.s.
UH1	+	-	n.s.
CH53A_D	+	-	n.s.
AH1	+	n.s.	n.s.
CH53E	n.s.	-	-
A6E	+	n.s.	n.s.
EA6B Electronic	+	-	n.s.

(Not Statistically Significant: n.s.)

(Source: Author, 2006)

Table 93. Multivariate Regression Results for Occupational Fields

Occupational Field	10 YCS Retention	O-4 Promotion	O-5 Promotion
Ground Support	-	n.s.	-
Service Support	-	n.s.	n.s.
Aviation Fixed Wing	+	-	n.s.
Aviation Rotary Wing	+	-	n.s.
Aviation Support	-	n.s.	n.s.

(Not Statistically Significant: n.s.)
(Source: Author, 2006)

The average promotion rates by PMOS, covering fiscal years 1990 through 2005, are shown in Table 94. The results of the O-4 Promotion Model show that 32% of the PMOSs are associated with whether an officer is promoted. Having a PMOS of 0402, Logistics officer, is positively correlated with being promoted to O-4, when compared to Infantry. The majority of pilot PMOSs (75XX) are negatively correlated with whether an on officer is promoted to O-4. The remaining PMOSs are not significantly different than Infantry. When PMOSs are grouped into occupational fields, the results show that aviation fixed- and rotary-wing occupational fields are negatively associated with being promoted to O-4, when compared to the combat arms occupational field. The three remaining occupational fields are not significantly different from the combat arms occupational field.

The results of the O-5 Promotion Model show that 19% of the PMOSs are associated with whether an officer is promoted. Having an Air Defense Control or FA18 PMOSs is positively correlated with promotion to O-5, compared to Infantry. Officers in the following PMOSs are less likely to be promoted to O-5: Intelligence, Engineers, Public Affairs, and CH53A_D. When PMOSs are grouped into occupational fields the results show that being in the Ground Support occupational field is negatively associated with whether an officer is promoted to O-5, compared to being in the combat arms occupational field. The four remaining occupational fields are not significantly different from the combat arms occupational field.

To summarize, the results indicate that PMOS has a statistically significant effect on whether an officer survives until 10 YCS. In addition when PMOSs are aggregated, an officer's occupational field is significantly correlated with the probability that an

officer stays until 10 YCS. The results indicate that PMOSs within the fixed- and rotary-wing occupational field are negatively correlated with whether an officer is promoted to O-4. This is of particular interest because officers in these occupational fields have a higher survival rate to 10 YCS than infantry officers, but are less likely to be promoted to O-4. However, the results from the O-5 Promotion Model indicate that several PMOSs are associated with whether an officer is promoted to O-5, but when PMOSs are aggregated, only the ground support occupational field is correlated.

Table 94. O-4 and O-5 Promotion Rates

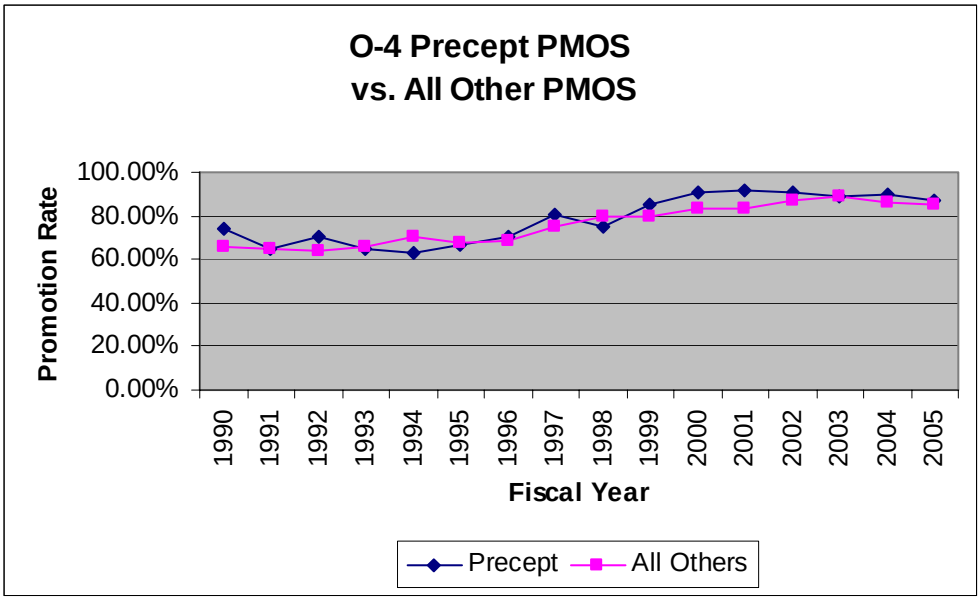
PMOS	0-4 Promotion % 1990 - 2005	O-4 Promotion % 2001 - 2005	0-5 Promotion % 1990 - 2005	O-5 Promotion % 2001 - 2005
0180	67.03%	83.87%	52.44%	39.47%
0202	77.98%	93.98%	59.05%	58.89%
0302	78.44%	95.18%	66.15%	69.87%
0402	77.86%	93.39%	59.15%	61.54%
0602	77.08%	89.73%	58.39%	60.48%
0802	76.60%	94.08%	59.60%	62.50%
1302	78.81%	91.75%	59.24%	64.06%
1802	76.02%	94.87%	62.22%	60.00%
1803	78.63%	89.29%	54.26%	52.17%
3002	73.96%	90.35%	59.50%	64.44%
3404	75.50%	89.66%	53.50%	71.43%
4302	68.75%	74.07%	53.06%	53.85%
4402	78.69%	85.39%	68.65%	66.67%
5803	72.87%	91.67%	62.50%	61.54%
6002	80.46%	90.70%	59.41%	61.54%
6602	78.95%	93.75%	67.96%	66.67%
7202	78.87%	85.29%	67.76%	76.36%
7509	72.32%	81.13%	68.50%	68.24%
7523	80.80%	82.48%	79.32%	79.00%
7543	74.39%	89.66%	87.50%	91.67%
7557	66.20%	69.75%	52.68%	51.28%
7562	75.23%	80.00%	63.41%	61.54%
7563	72.13%	78.85%	59.22%	58.14%
7564	66.67%	61.11%	62.10%	60.00%
7565	80.65%	89.80%	70.13%	67.47%
7566	76.53%	84.53%	62.21%	63.95%
Board Average	**76.42%**	**87.07%**	**62.93%**	**65.00%**

(Source: Author, 2006)

The current promotion system does not adequately address the mismatches between inventories and requirements based on the results in Tables 90 and 91. During fiscal years 1990 through 2005, only 20% of the critically short PMOSs were above 85% of the GAR requirement after the promotion board, when looking at promotion to O-4 and accounting for promotions to O-5. During fiscal years 1990 through 2005, only 27% of critically short PMOSs were above 85% of the GAR requirement after the promotion board, when looking at promotion to O-5 and accounting for promotions to O-6. A limiting factor in the effectiveness of the promotion system is the number of qualified officers within a given PMOS when the promotion board convenes.

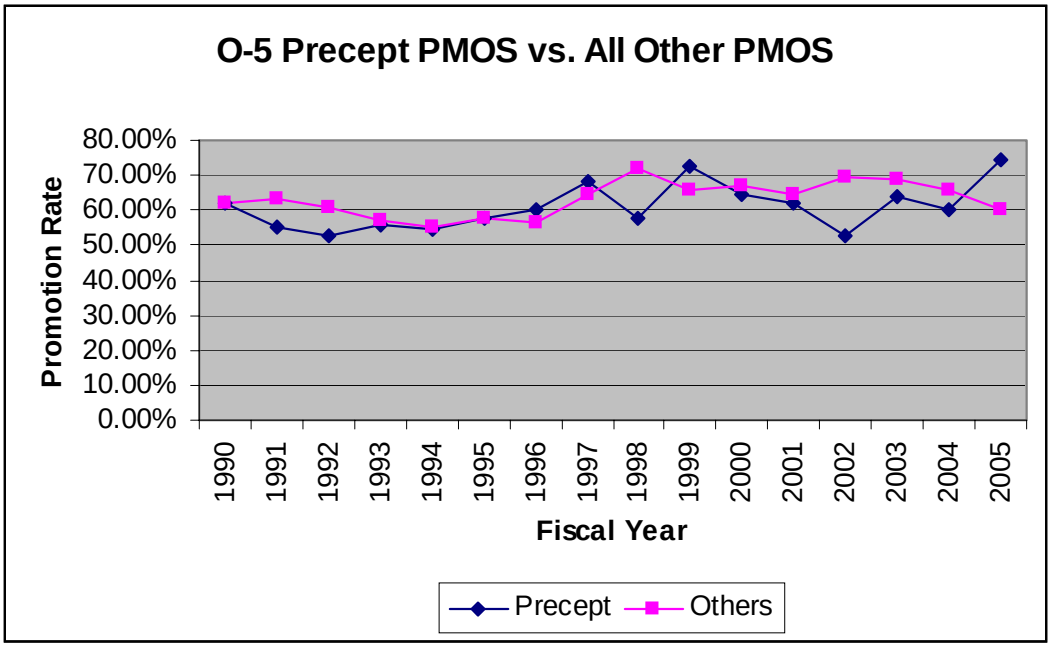
The current promotion system does not promote by PMOS; however board members are given a list of critically short PMOSs which they use to determine which officers are the best and most fully qualified and who meets the needs of the Marine Corps. If two officers are identical in the eyes of the board and one of the officers is in a critically short PMOS, then he or she should be selected based on the guidance given in the precept. The O-4 promotion rates for officers who have a critically short PMOS are, on average, higher than officers who did not possess a critically short PMOS, as seen in Figure 29. Officers with a critically short PMOS have on average a three percent higher promotion rate to O-4 than officers in the remaining PMOSs. However, the reverse is true for O-5 promotion rates. The O-5 promotion rates for officers who have a critically short PMOS are, on average, lower than officers who did not possess a critically short PMOS, as seen in Figure 30. Officers with a critically short PMOS have a three percent lower promotion rate to O-5 than officers in the remaining PMOSs.

Figure 29. O4- Precept PMOS vs. All Other PMOS



A precept PMOS is below 85% of the GAR (critical short PMOSs)
(Source: Author, 2006)

Figure 30. O5- Precept PMOS vs. All Other PMOS



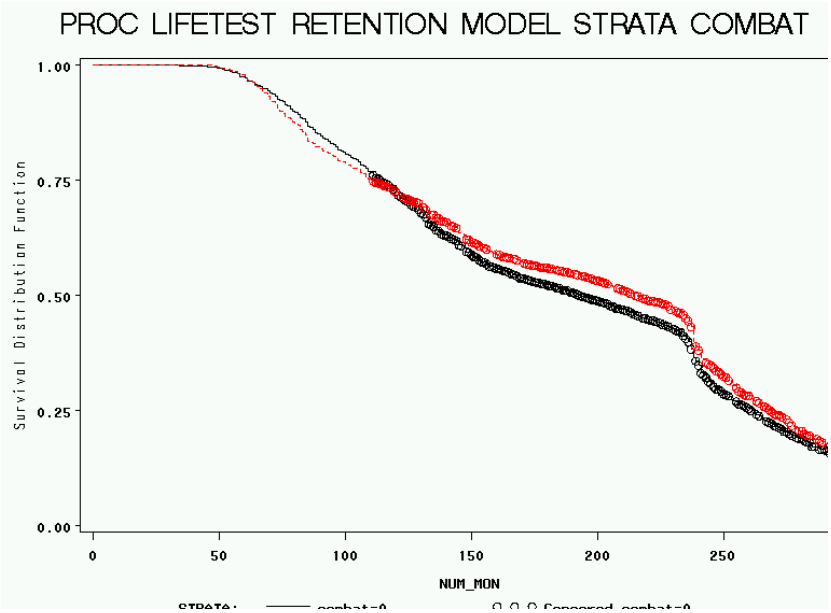
A precept PMOS is below 85% of the GAR (critical short PMOSs)
(Source: Author, 2006)

B. RECOMMENDATIONS

This thesis found that retention and promotion rates of Marine Corps officers differ significantly among individual PMOSs and also among occupational fields. In addition, certain PMOSs have historically been critically short and the HRDP has been unable to correct mismatches between inventories and requirements. In order to re-align requirements and inventories, the Marine Corps could offer career bonuses to officers in critically short PMOSs, especially Intelligence officers. Another option is to increase accessions in historically short PMOSs and lower accessions into other PMOSs which are never critically short. Increasing the minimum obligation time for officers in historically short PMOSs could increase the probability that an officer will stay until 10 YCS, as is suggested by the number of pilots who stay. In order to address the differences in promotion rates between PMOSs, the Marine Corps could investigate the factors that make one officer more competitive than another and continue to provide career counseling focused on those factors. In addition, the president of the promotion board could group officers by PMOS and have separate individuals brief each PMOS. This would allow the briefer to give a recommendation to the board on who are the best and most qualified officers within that PMOS. In addition, this would allow board members to compare all officers in a particular PMOS to their peers before selecting the best and most fully qualified.

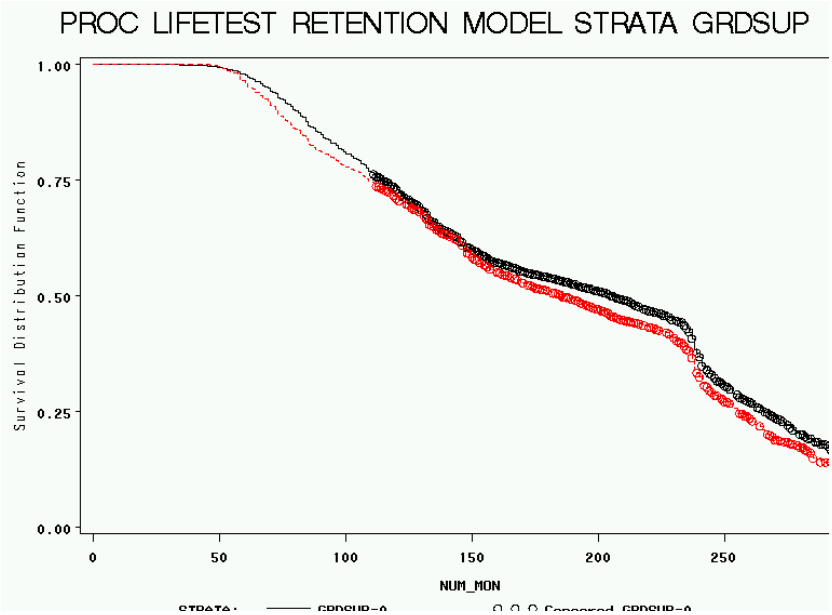
APPENDIX A. LIFETEST RESULTS FOR RETENTION MODEL

A. PROC LIFETEST RESULTS FOR OCCUPATIONAL GROUPS

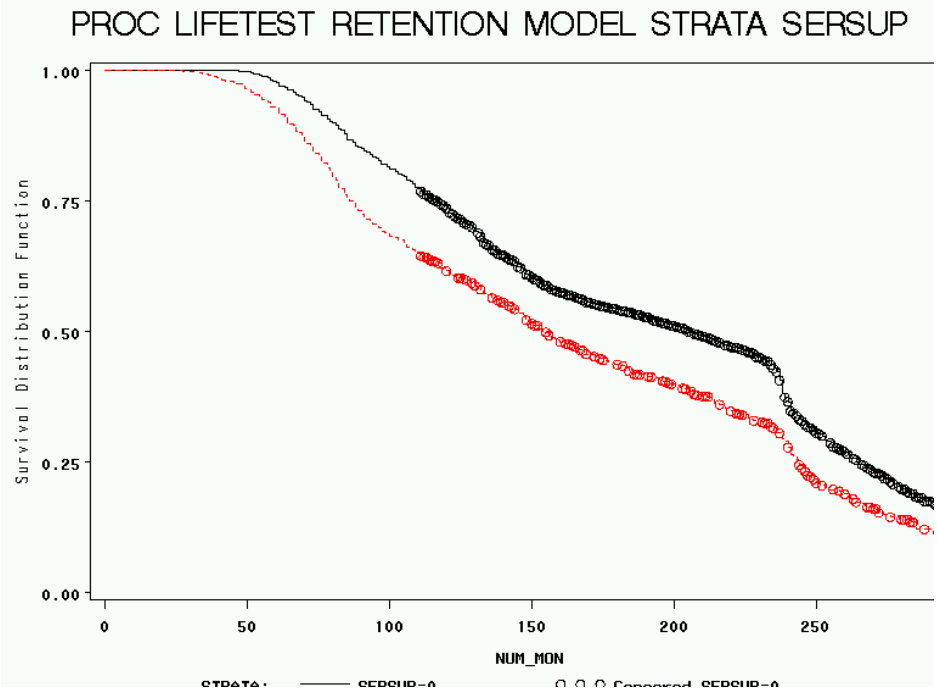


Combat = 0 (Black) Combat = 1 (Red)

(Source: Author, 2006)

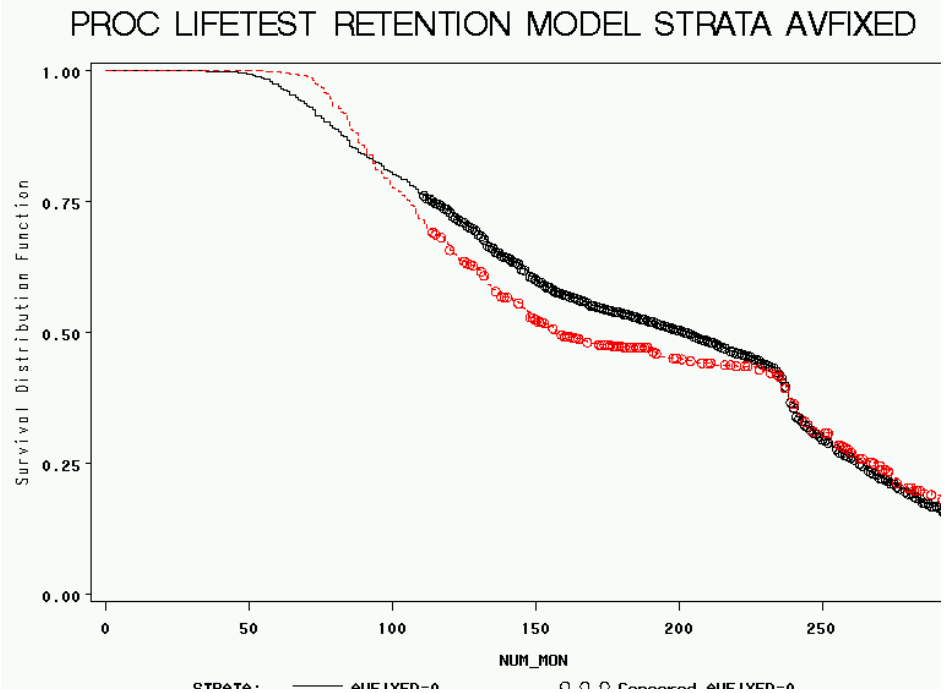


Ground Support = 0 (Black) Ground Support = 1 (Red)
(Source: Author, 2006)



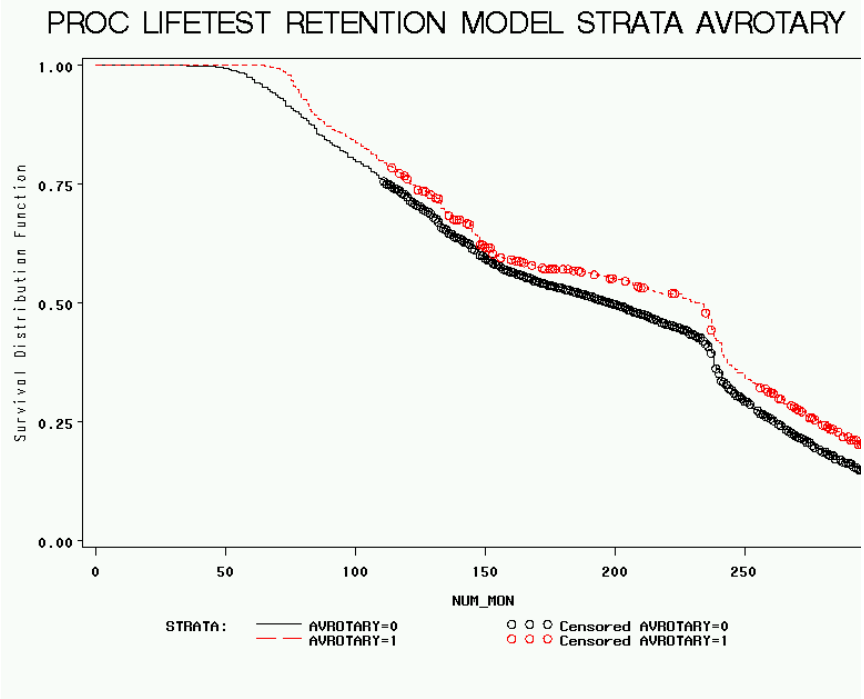
Service Support = 0 (Black) Service Support = 1 (Red)

(Source: Author, 2006)



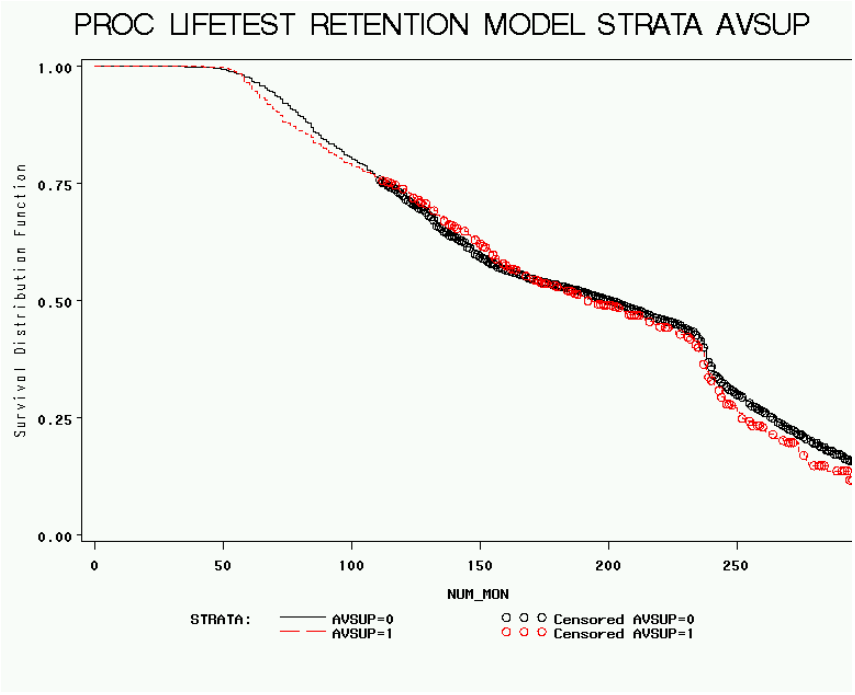
Aviation Fixed Wing = 0 (Black) Aviation Fixed Wing = 1 (Red)

(Source: Author, 2006)



Aviation Rotary Wing = 0 (Black) Aviation Rotary Wing = 1 (Red)

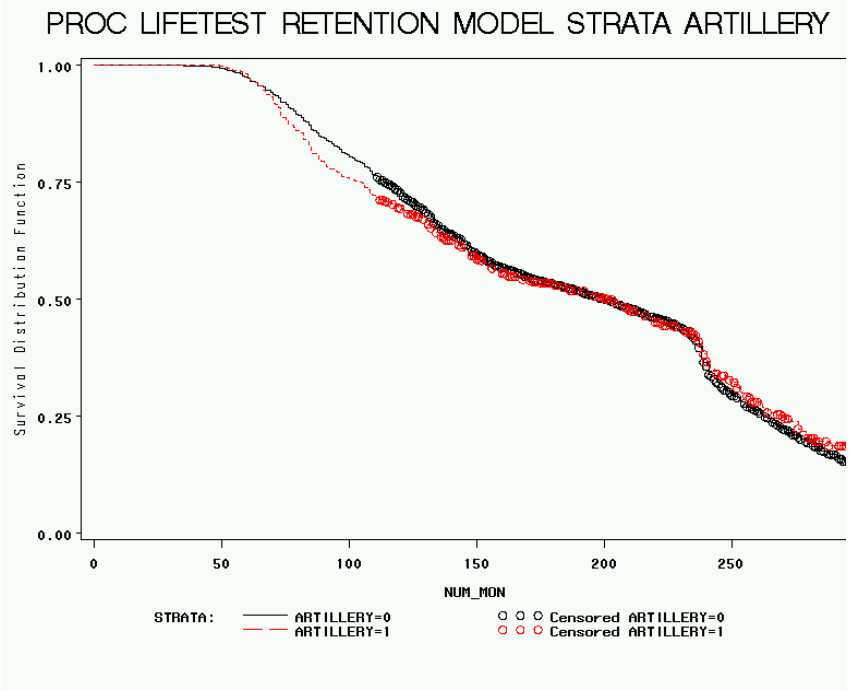
(Source: Author, 2006)



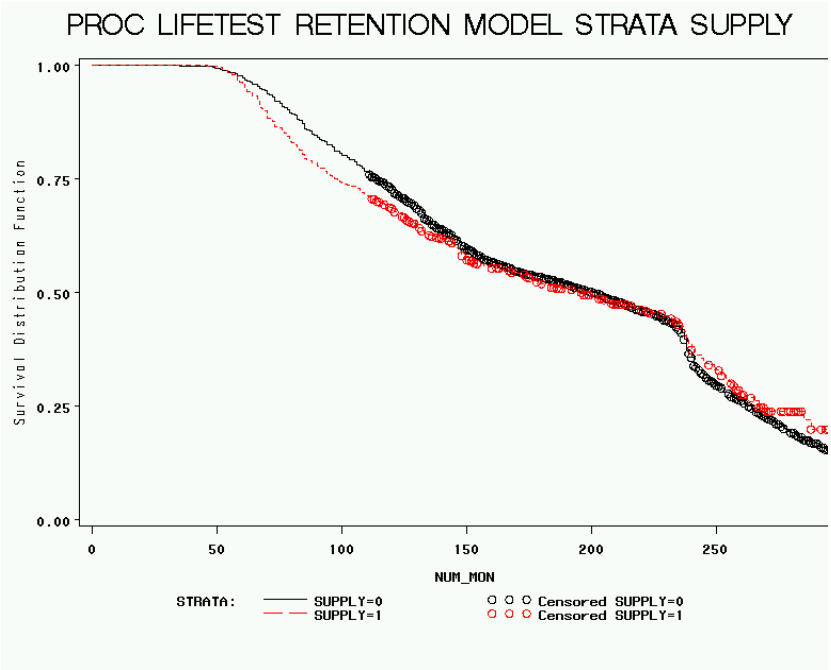
Aviation Support = 0 (Black) Aviation Support = 1 (Red)

(Source: Author, 2006)

B. PROC LIFETEST RESULTS FOR SELECTED PMOS'S

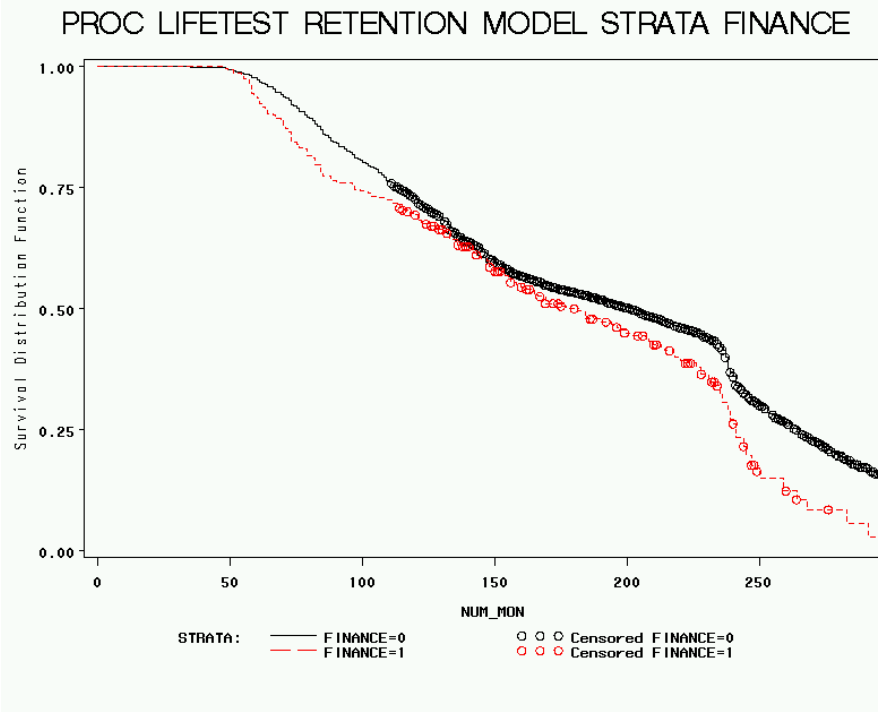


Artillery = 0 (Black) Artillery = 1 (Red)
(Source: Author, 2006)



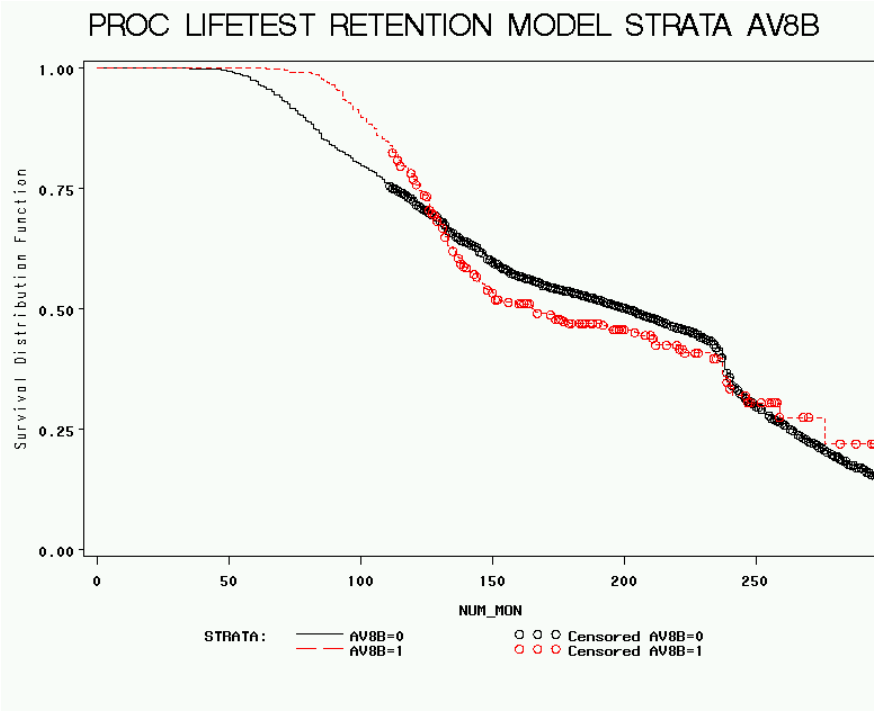
Supply = 0 (Black) Supply = 1 (Red)

(Source: Author, 2006)



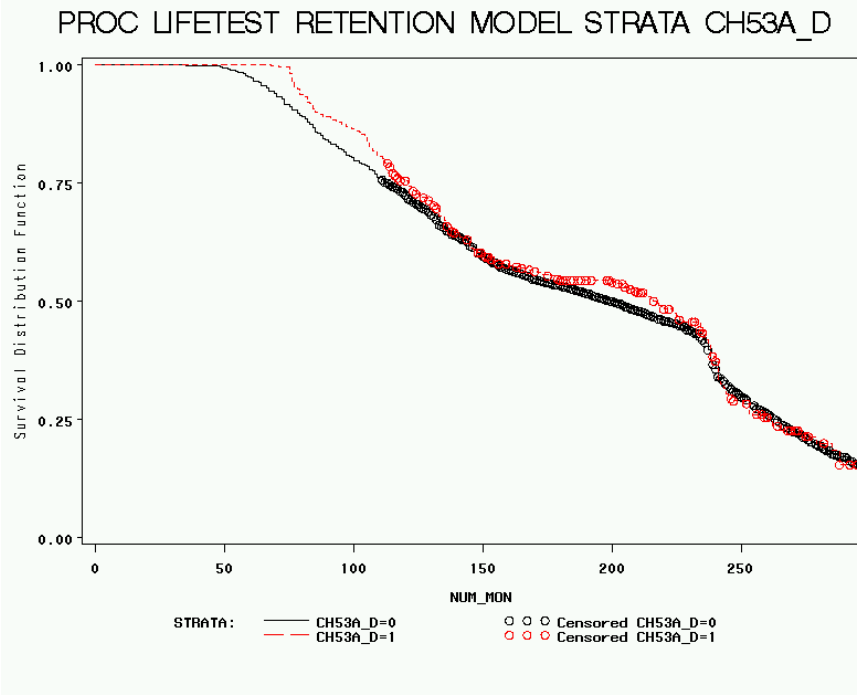
Finance = 0 (Black) Finance = 1 (Red)

(Source: Author, 2006)



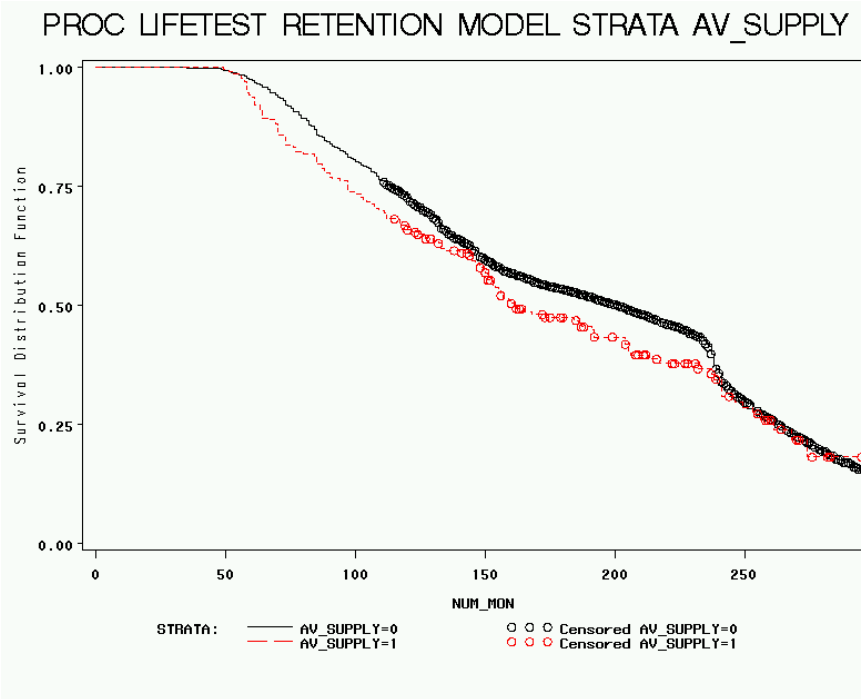
AV8B = 0 (Black) AV8B = 1 (Red)

(Source: Author, 2006)



CH 53 A - D = 0 (Black) CH 53 A - D = 1 (Red)

(Source: Author, 2006)

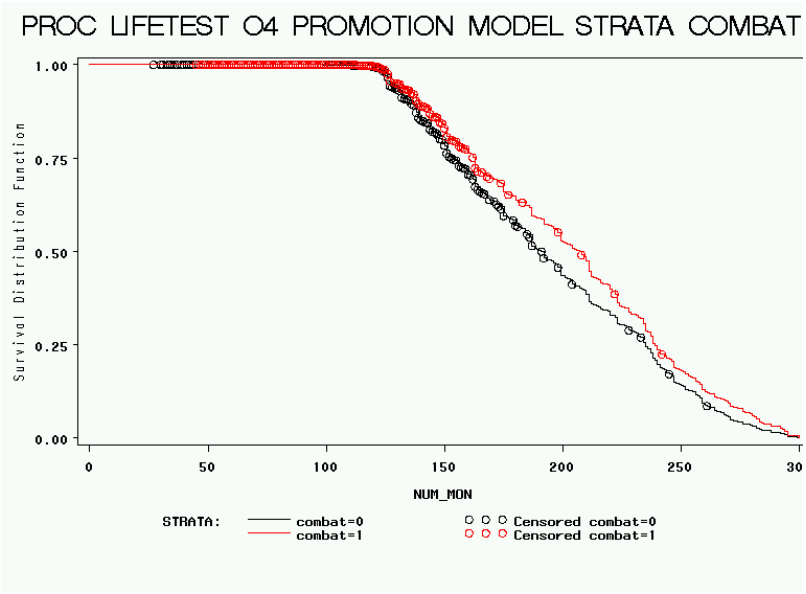


Aviation Supply= 0 (Black) Aviation Supply = 1 (Red)

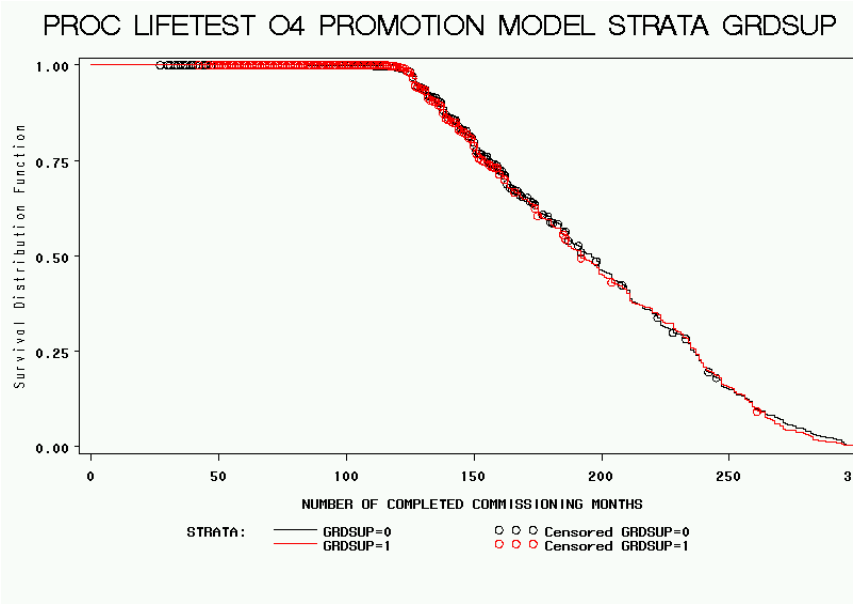
(Source: Author, 2006)

APPENDIX B. LIFETEST RESULTS FOR O-4 PROMOTION MODEL

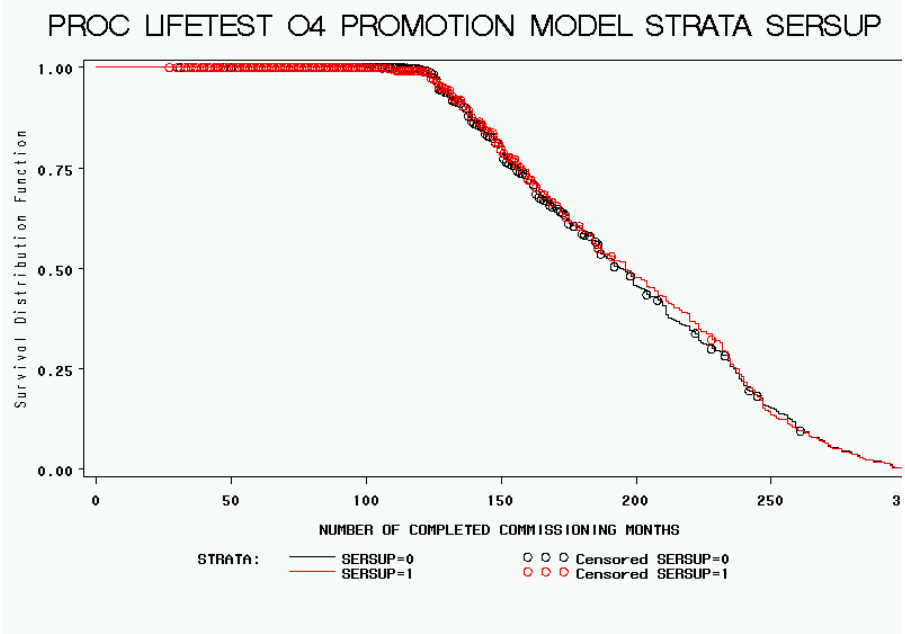
A. PROC LIFETEST RESULTS FOR OCCUPATIONAL GROUPS



Combat = 0 (Black) Combat = 1 (Red)
(Source: Author, 2006)

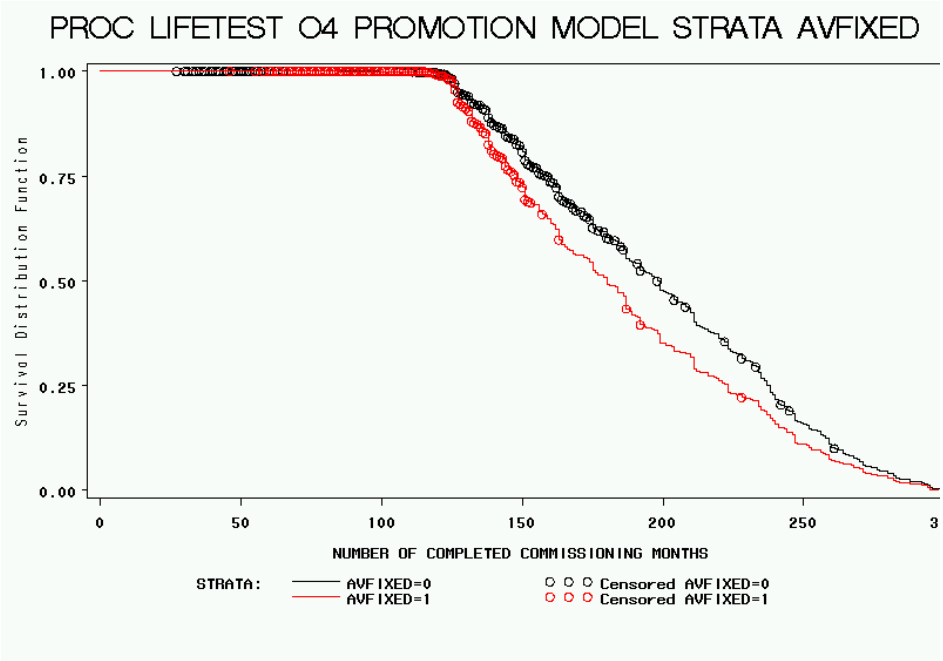


Ground Support = 0 (Black) Ground Support = 1 (Red)
(Source: Author, 2006)



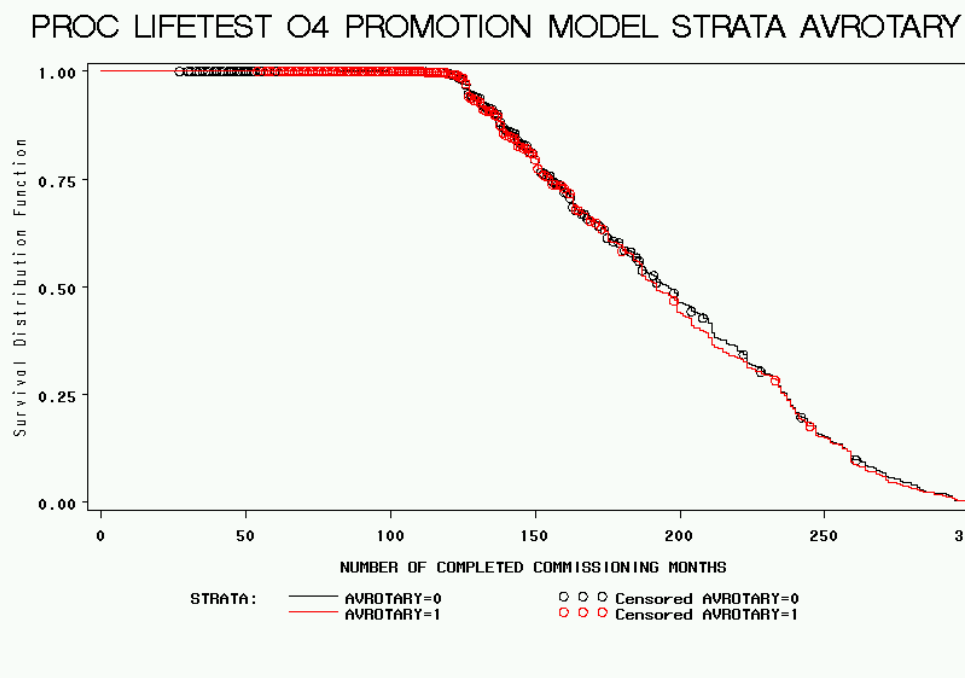
Service Support = 0 (Black) Service Support = 1 (Red)

(Source: Author, 2006)

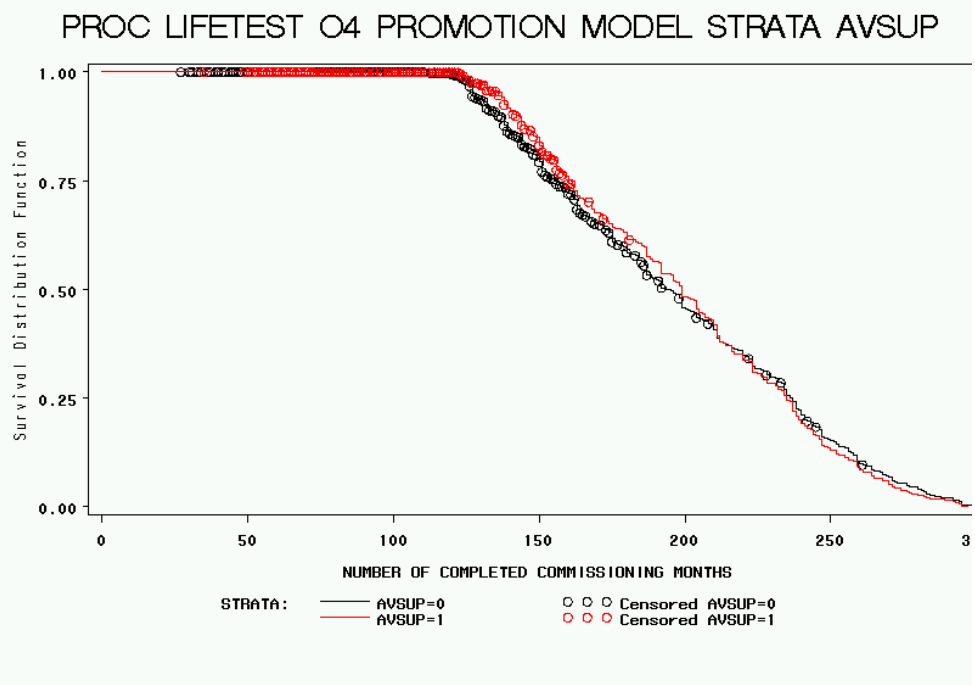


Aviation Fixed Wing = 0 (Black) Aviation Fixed Wing = 1 (Red)

(Source: Author, 2006)



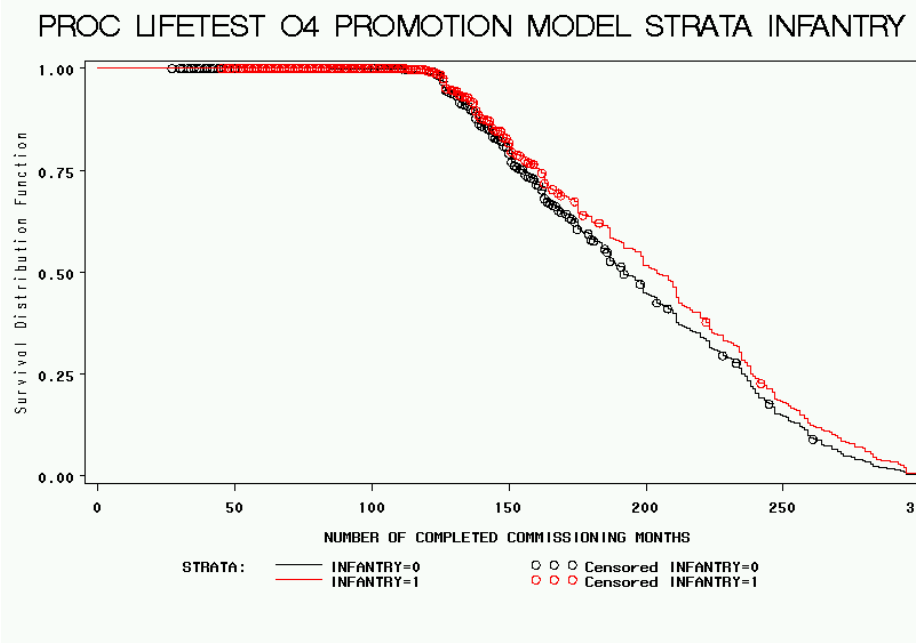
Aviation Rotary Wing = 0 (Black) Aviation Rotary Wing = 1 (Red)
(Source: Author, 2006)



Aviation Support = 0 (Black) Aviation Support = 1 (Red)

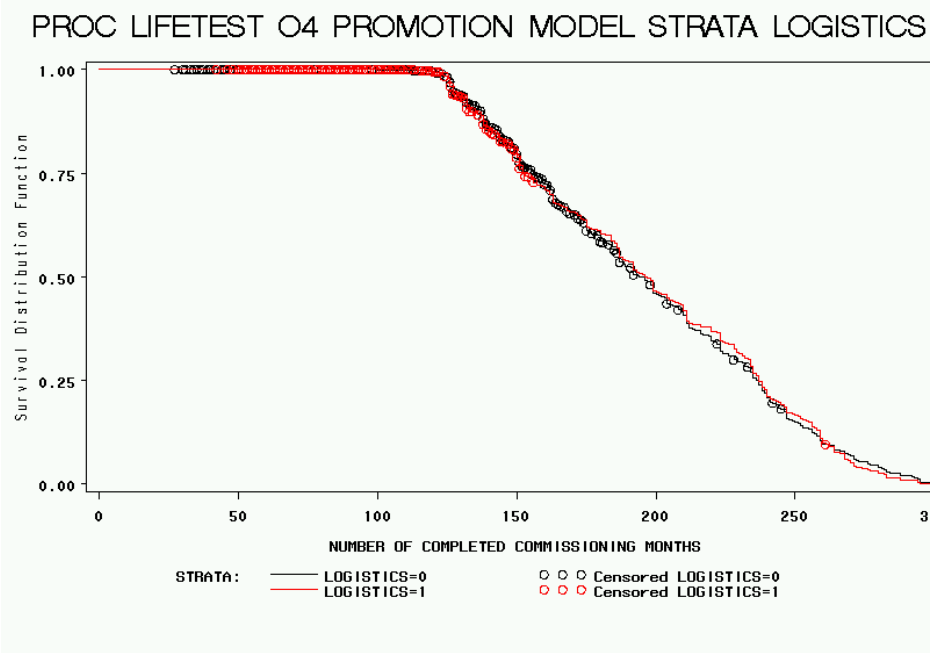
(Source: Author, 2006)

B. PROC LIFETEST RESULTS FOR SELECTED PMOS'S



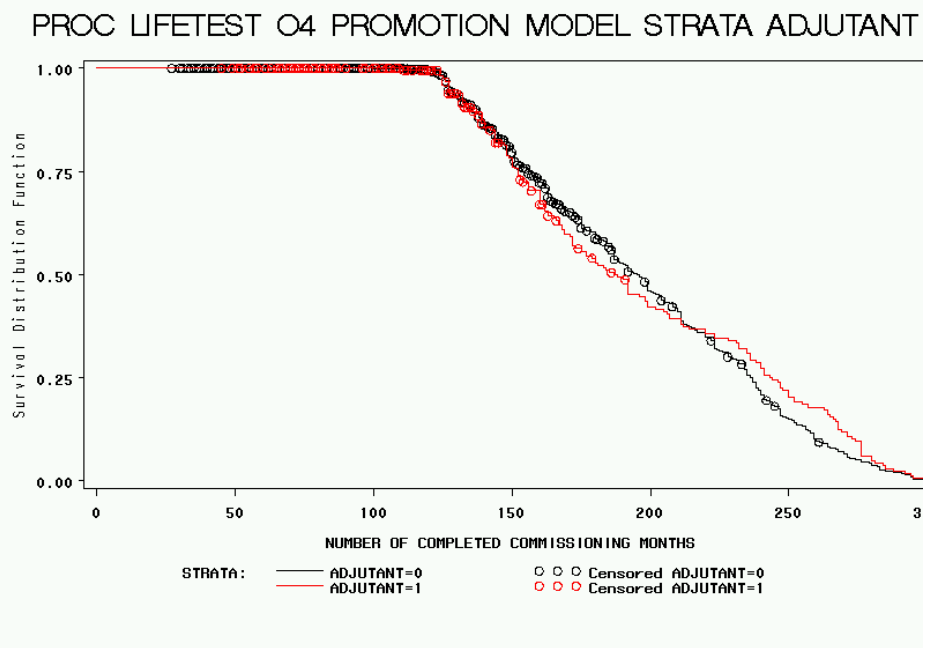
Infantry = 0 (Black) Infantry = 1 (Red)

(Source: Author, 2006)



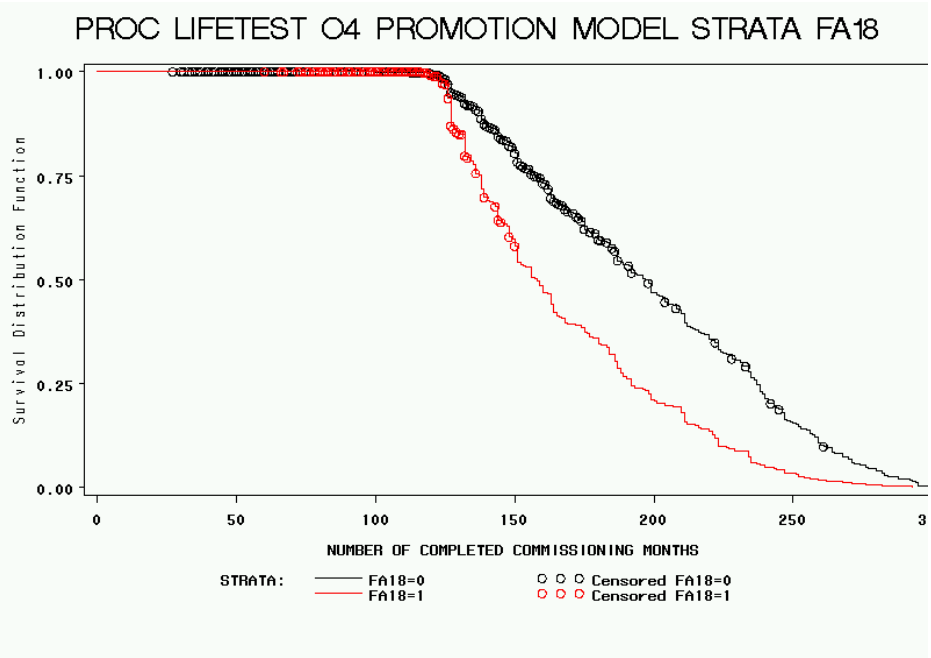
Logistics = 0 (Black) Logistics = 1 (Red)

(Source: Author, 2006)



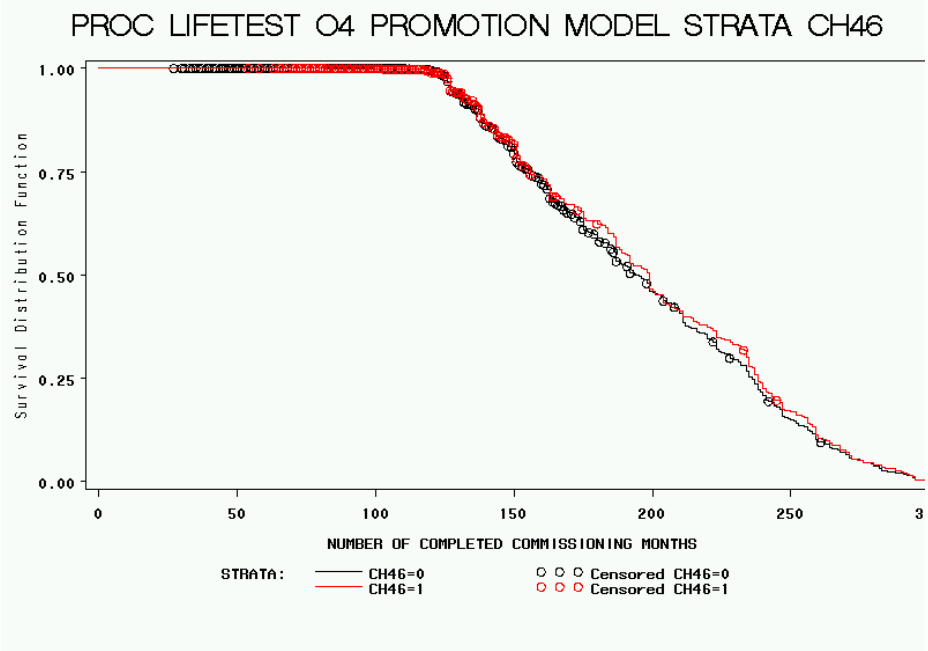
Adjutant = 0 (Black) Adjutant = 1 (Red)

(Source: Author, 2006)

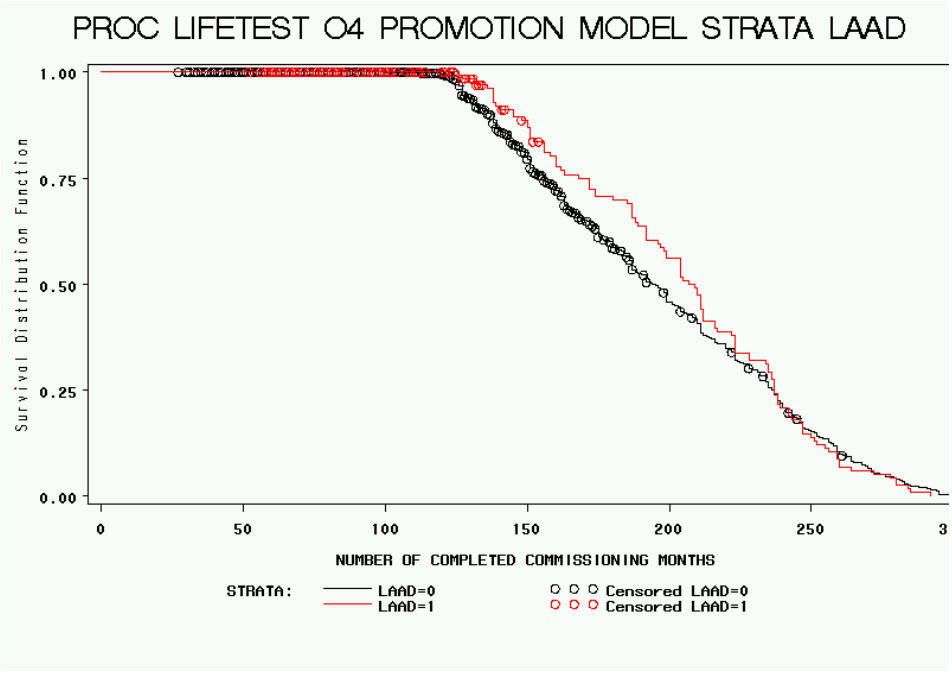


F/A 18 = 0 (Black) F/A 18 = 1 (Red)

(Source: Author, 2006)



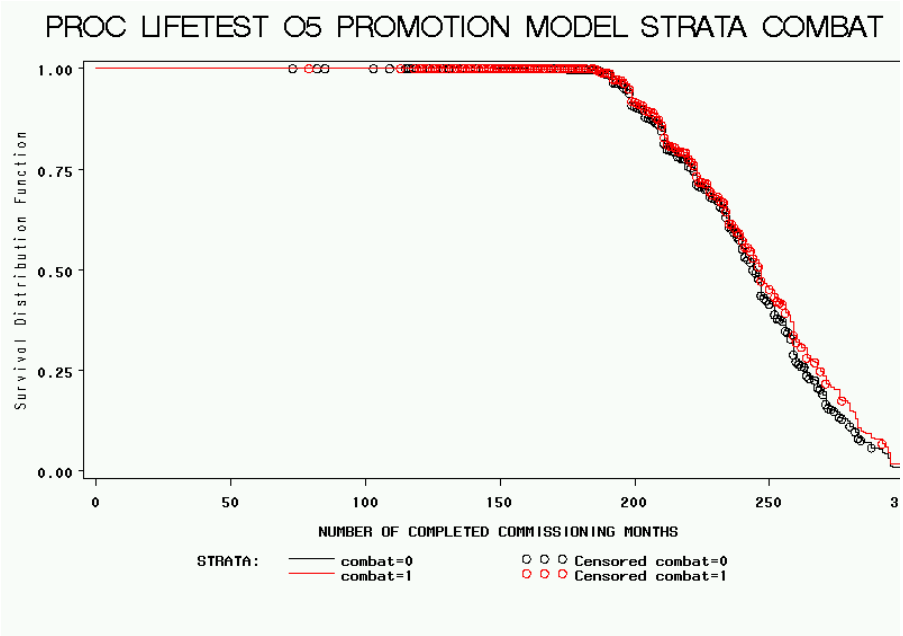
CH 46 = 0 (Black) CH 46 = 1 (Red)
(Source: Author, 2006)



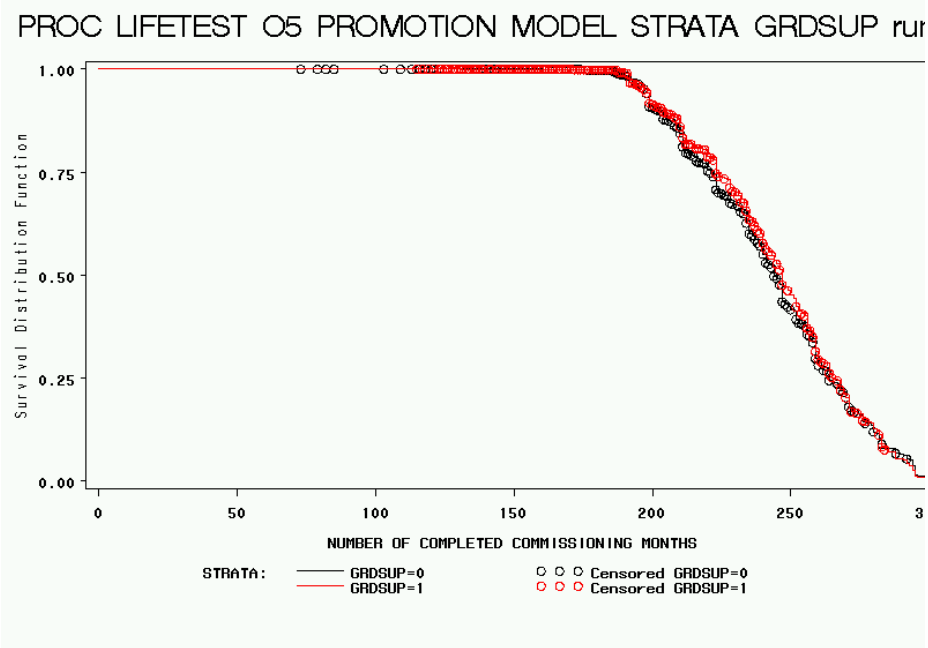
LAAD = 0 (Black) LAAD = 1 (Red)
(Source: Author, 2006)

APPENDIX C: LIFETEST RESULTS FOR O-5 PROMOTION MODEL

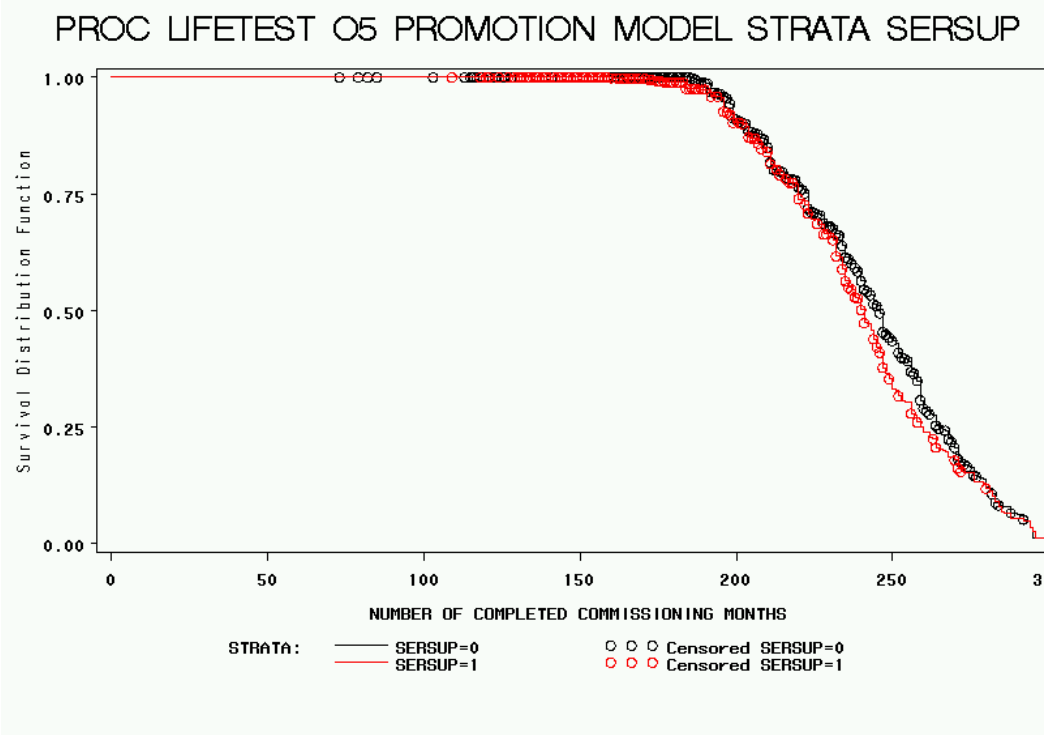
A. PROC LIFETEST RESULTS FOR OCCUPATIONAL GROUPS



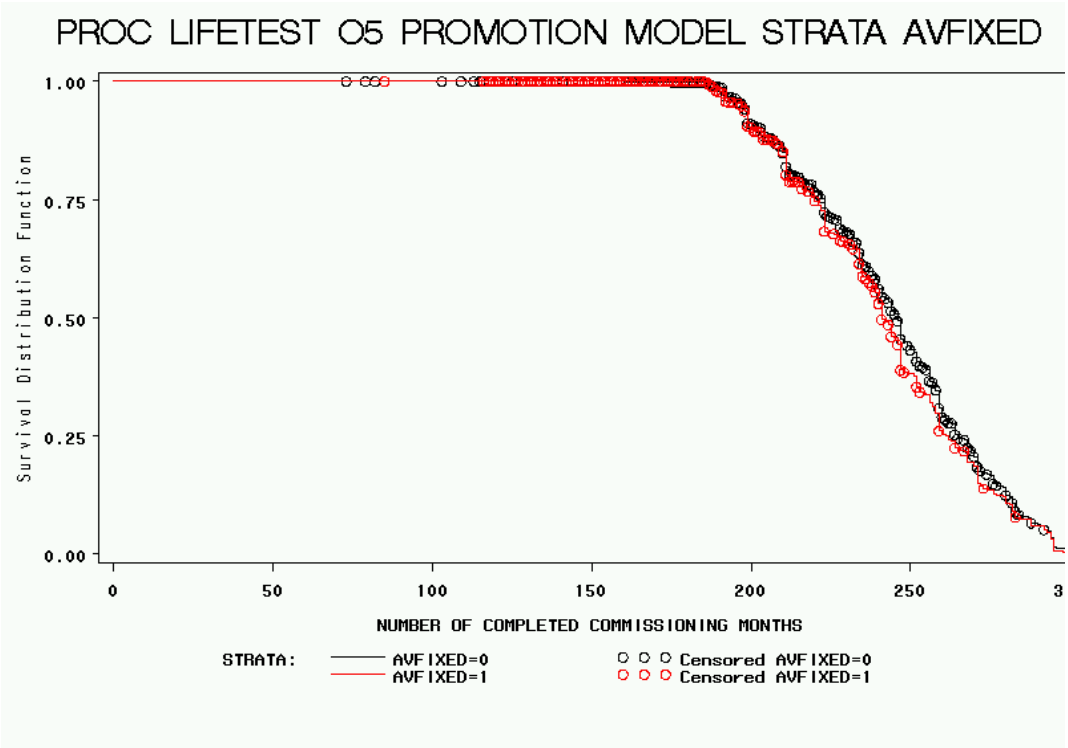
(Source: Author, 2006)



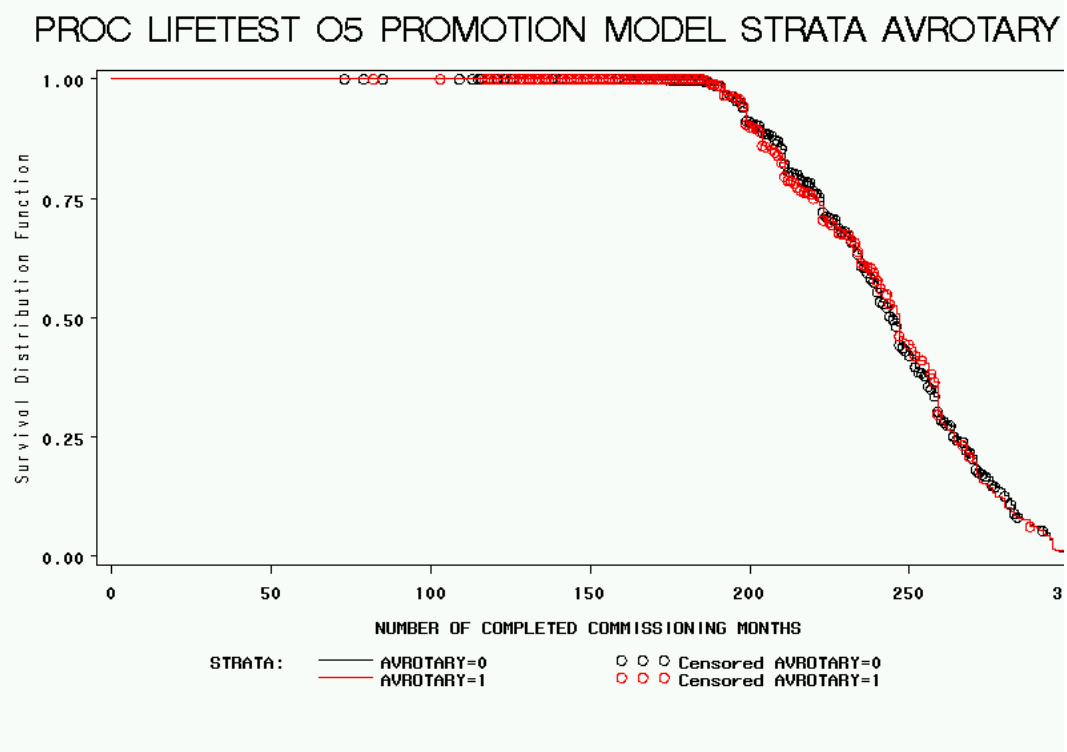
(Source: Author, 2006)



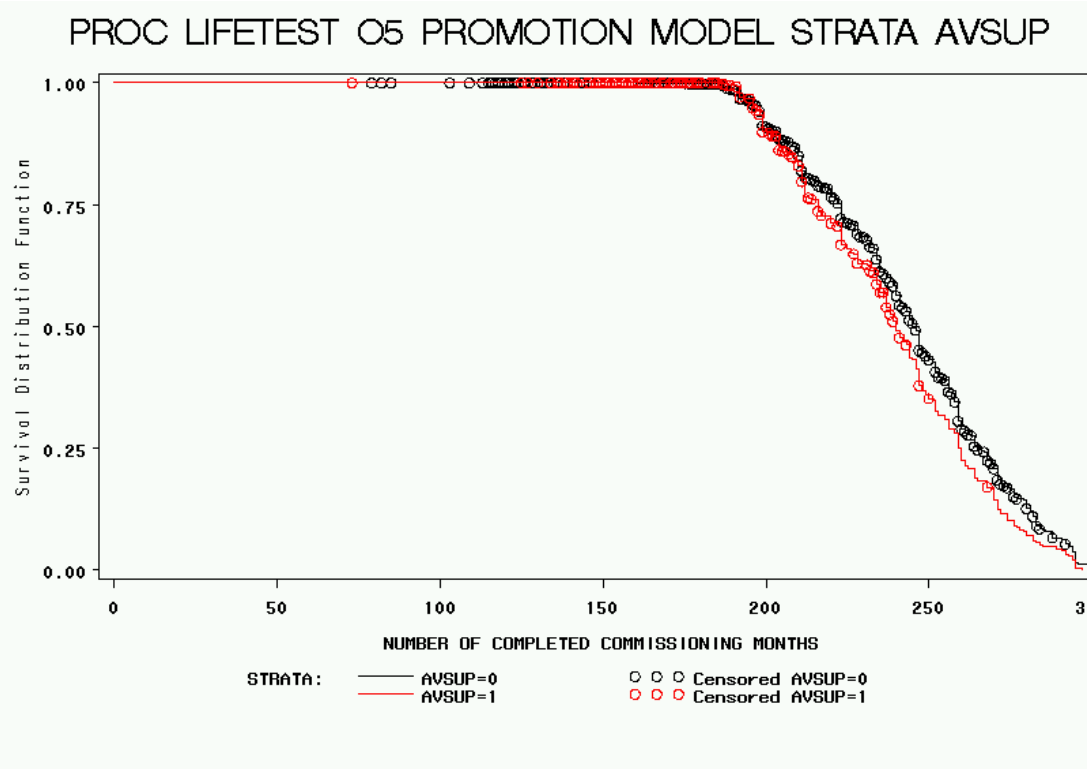
(Source: Author, 2006)



(Source: Author, 2006)

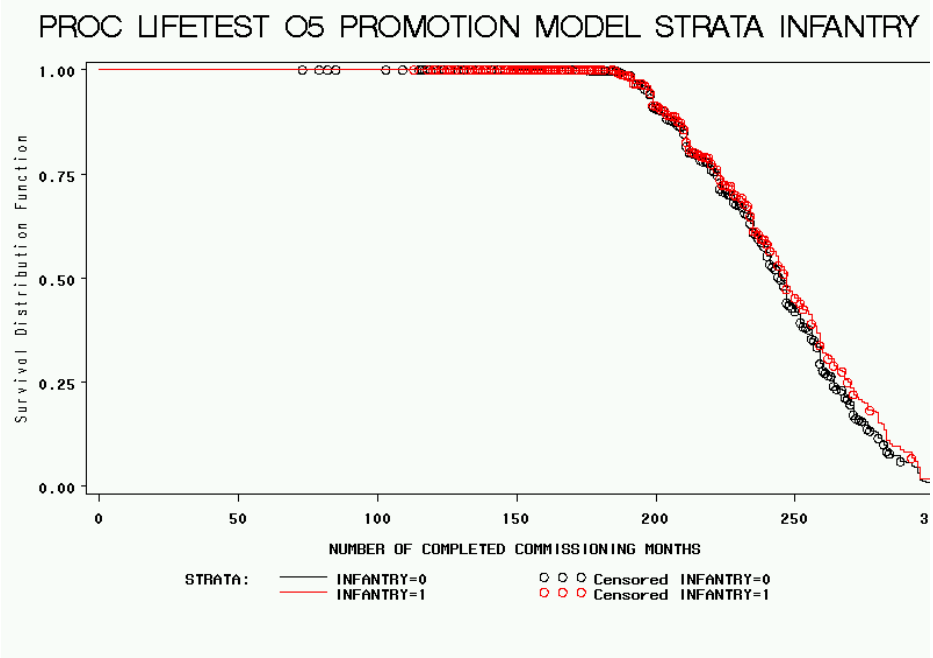


(Source: Author, 2006)

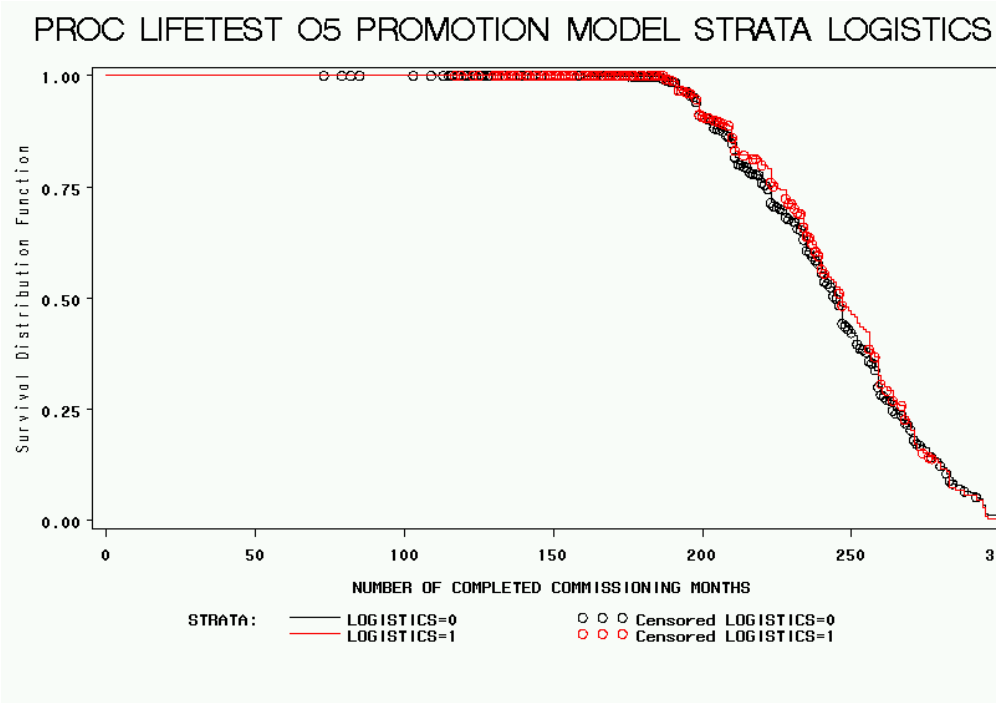


(Source: Author, 2006)

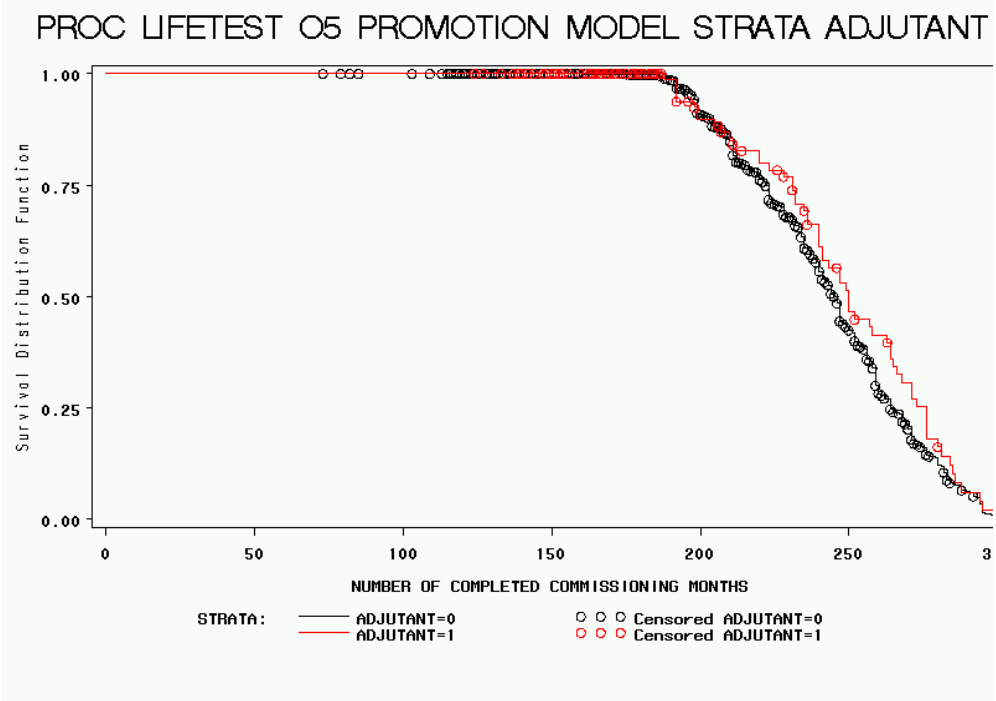
B. PROC LIFETEST RESULTS FOR SELECTED PMOS'S



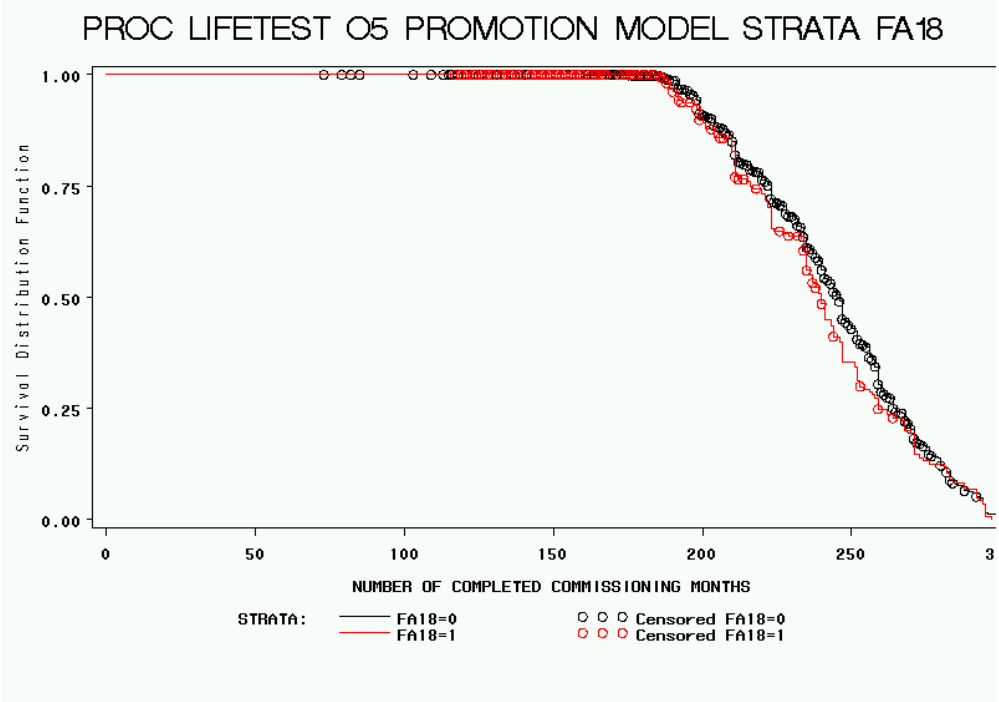
(Source: Author, 2006)



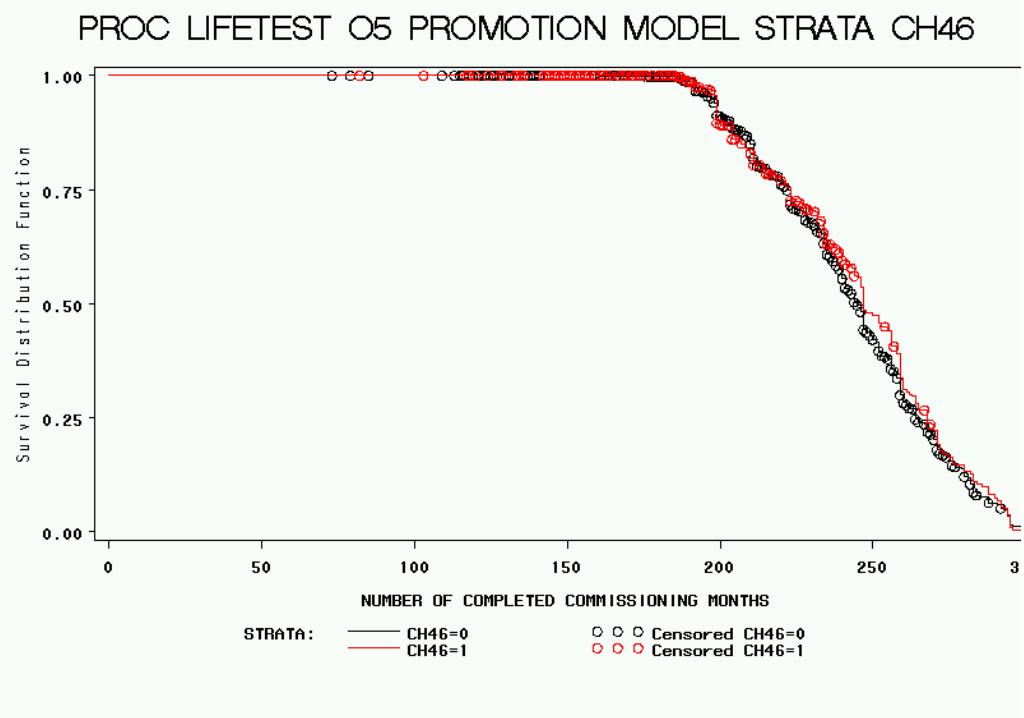
(Source: Author, 2006)



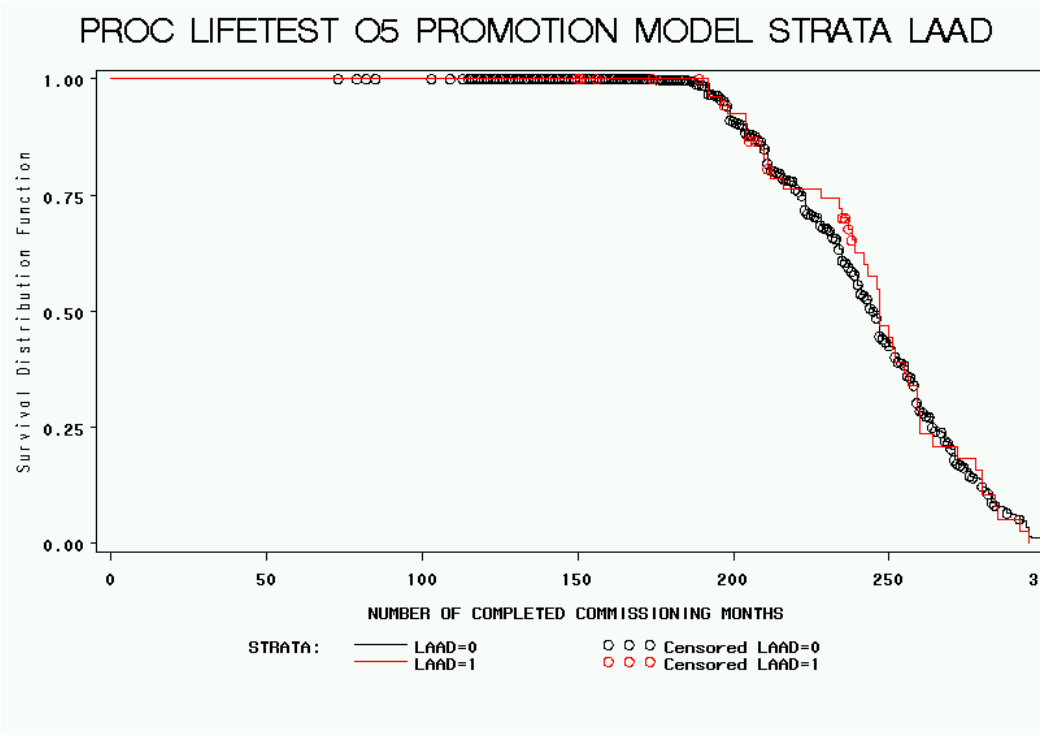
(Source: Author, 2006)



(Source: Author, 2006)



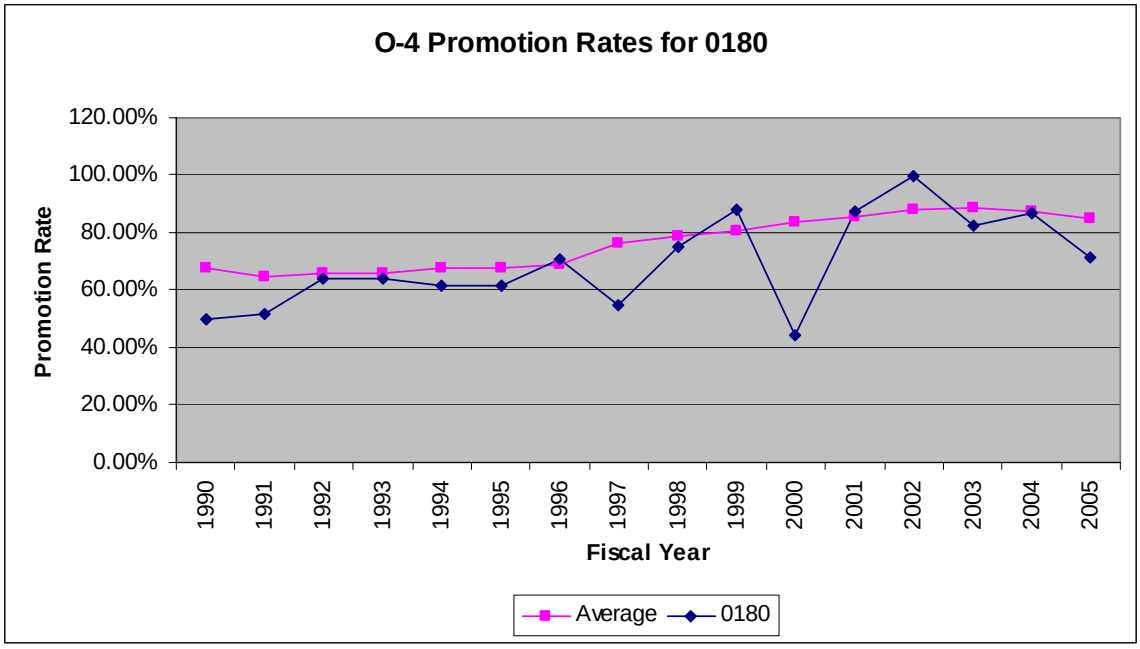
(Source: Author: 2006)



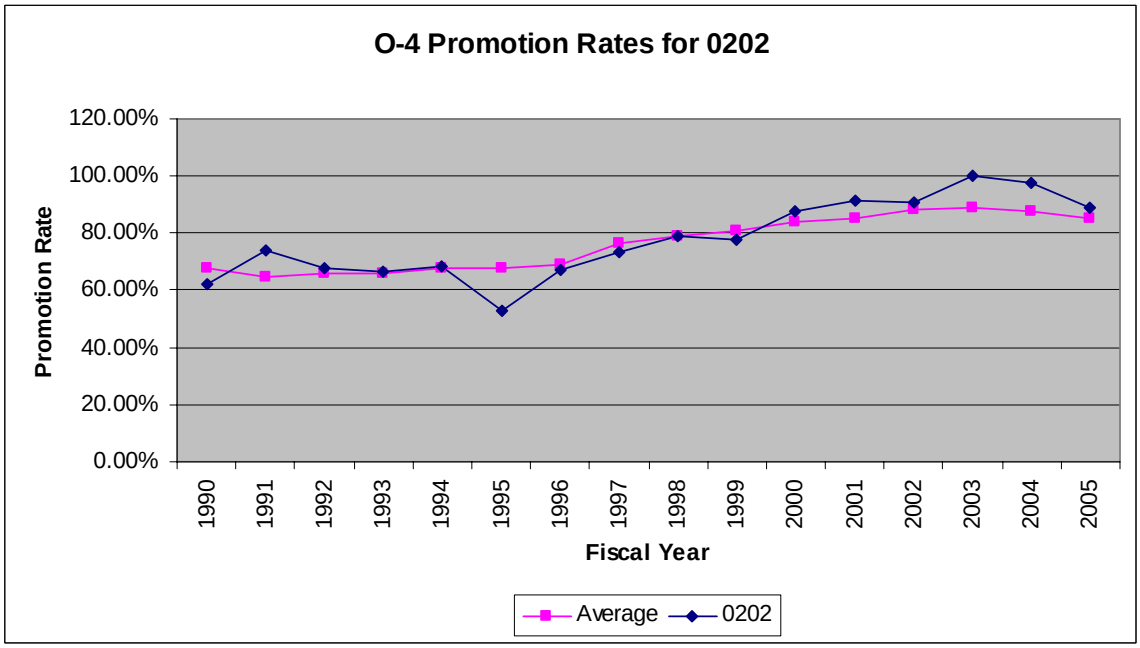
(Source: Author, 2006)

APPENDIX D. PROMOTION RATE COMPARISONS BY PMOS

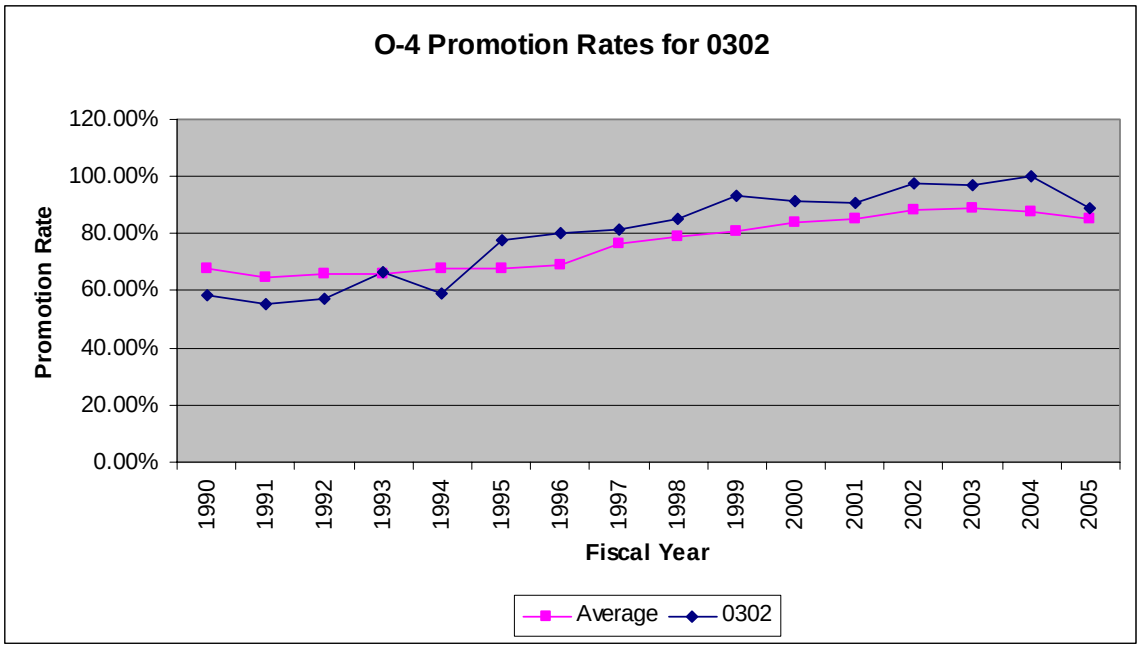
A. O-4 PROMOTION RATES BY PMOS



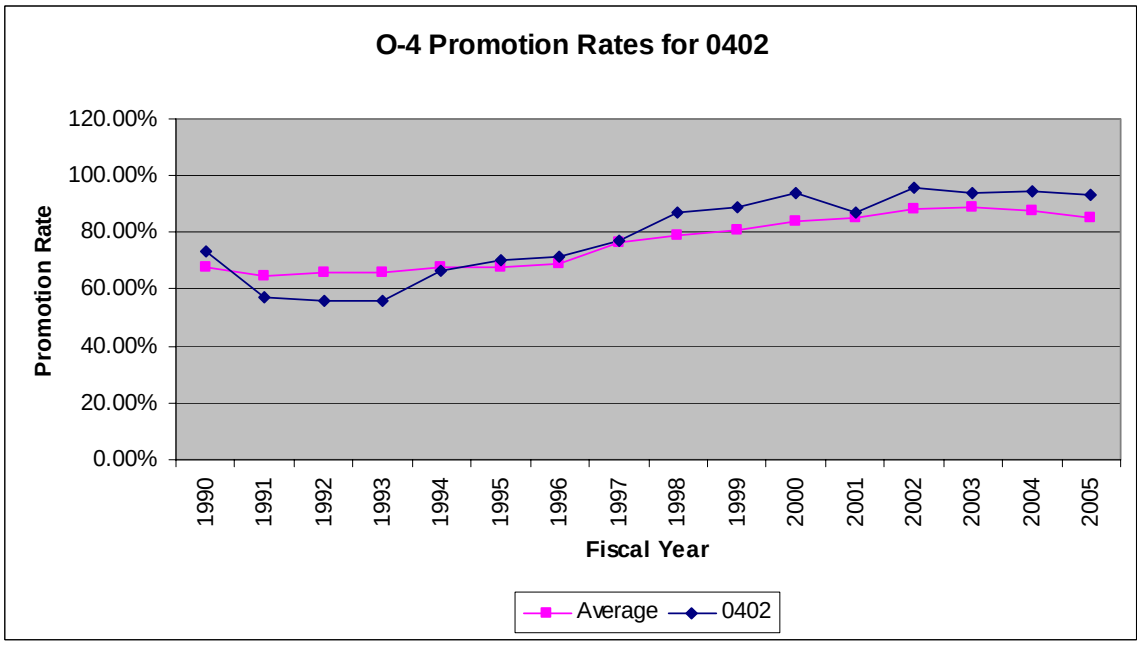
(Source: Author, 2006)



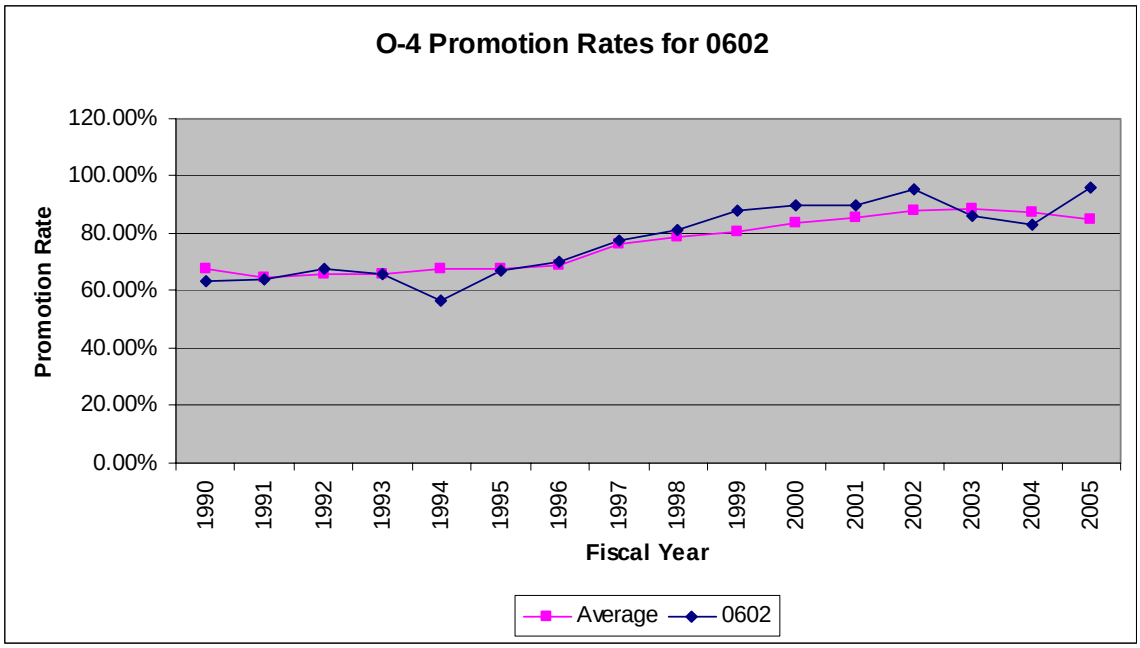
(Source: Author, 2006)



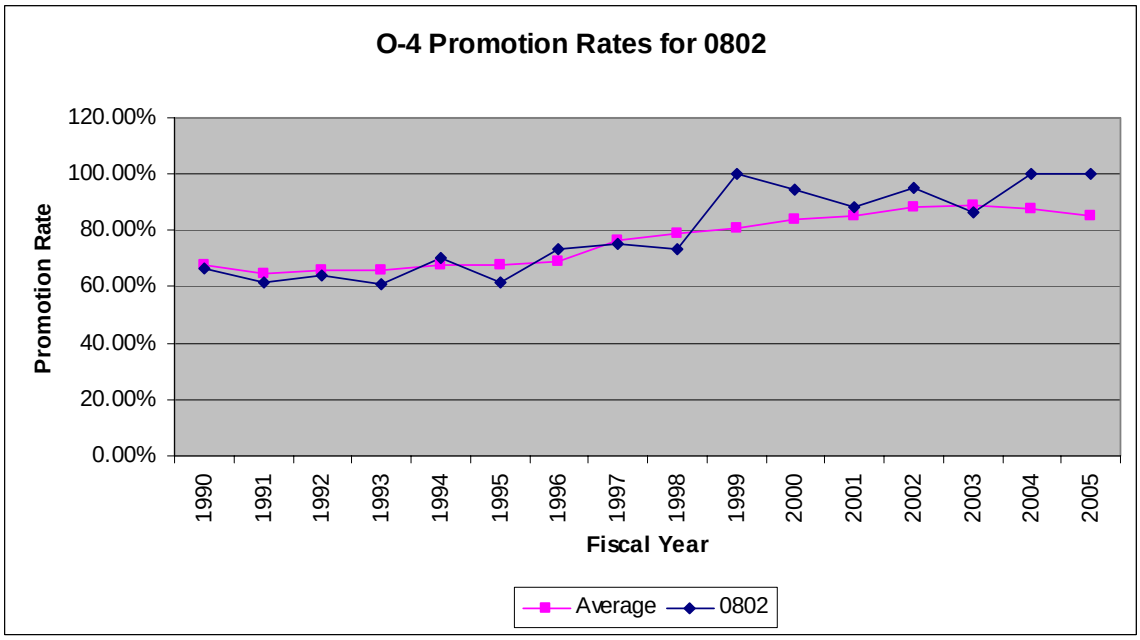
(Source: Author, 2006)



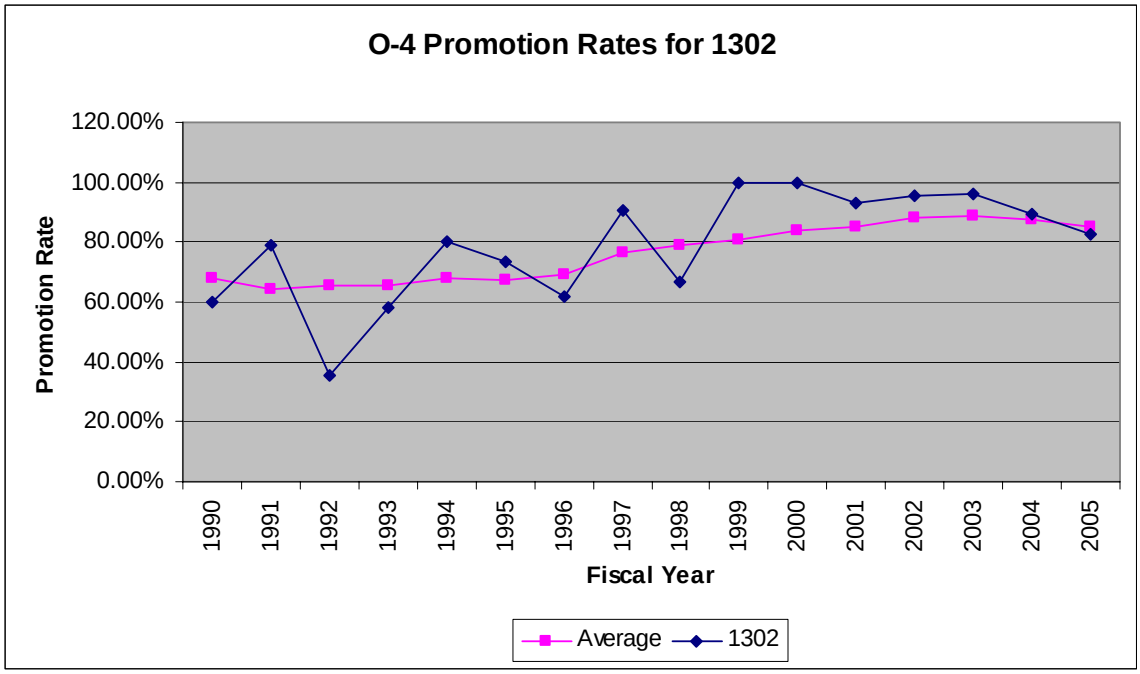
(Source: Author, 2006)



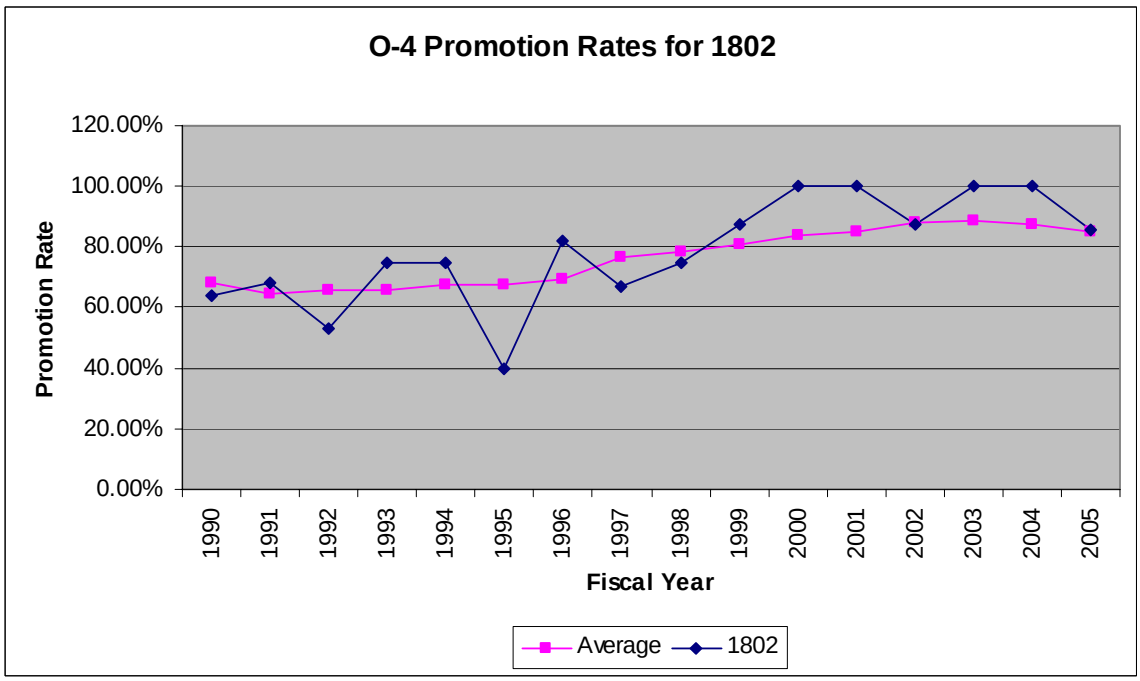
(Source: Author, 2006)



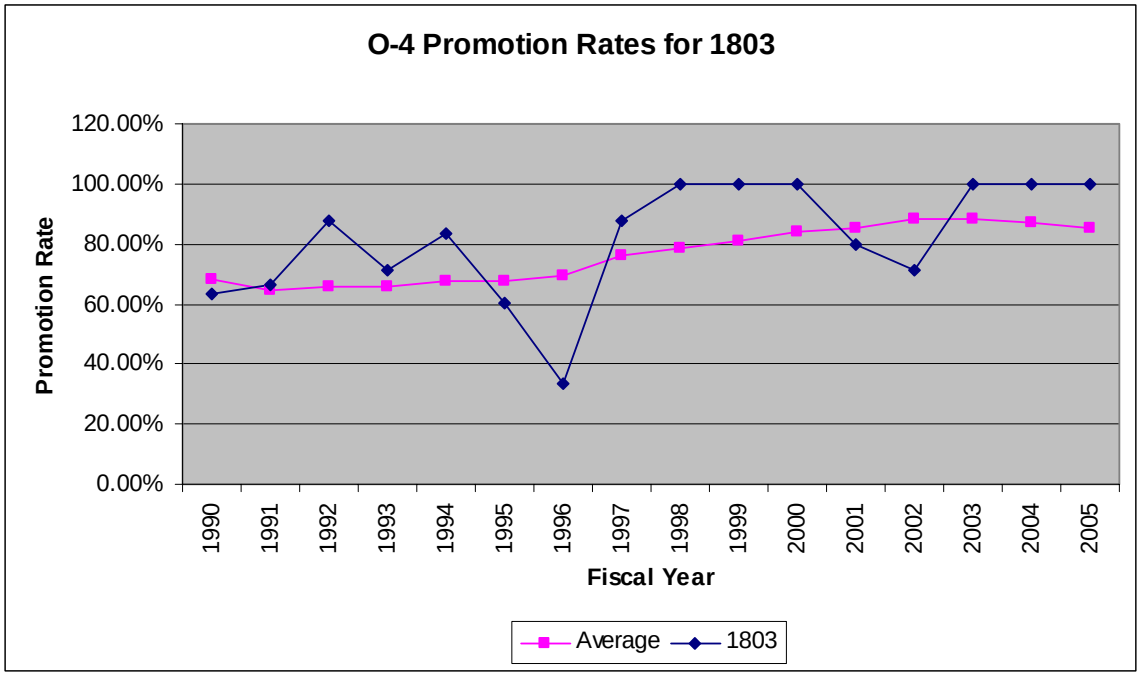
(Source: Author, 2006)



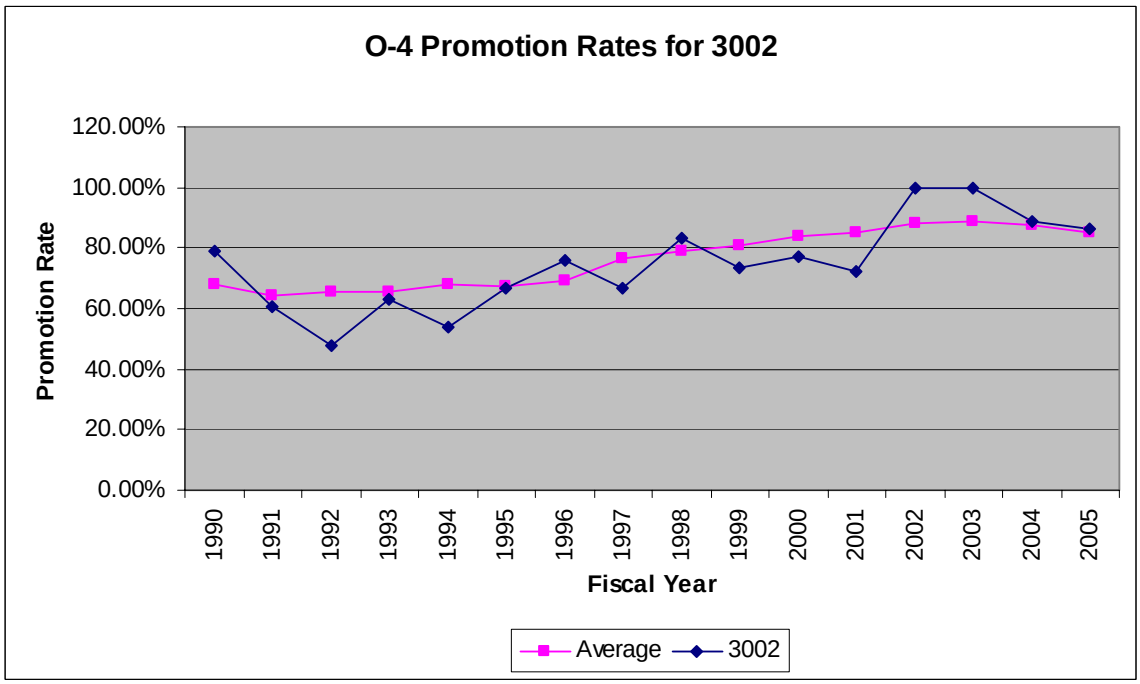
(Source: Author, 2006)



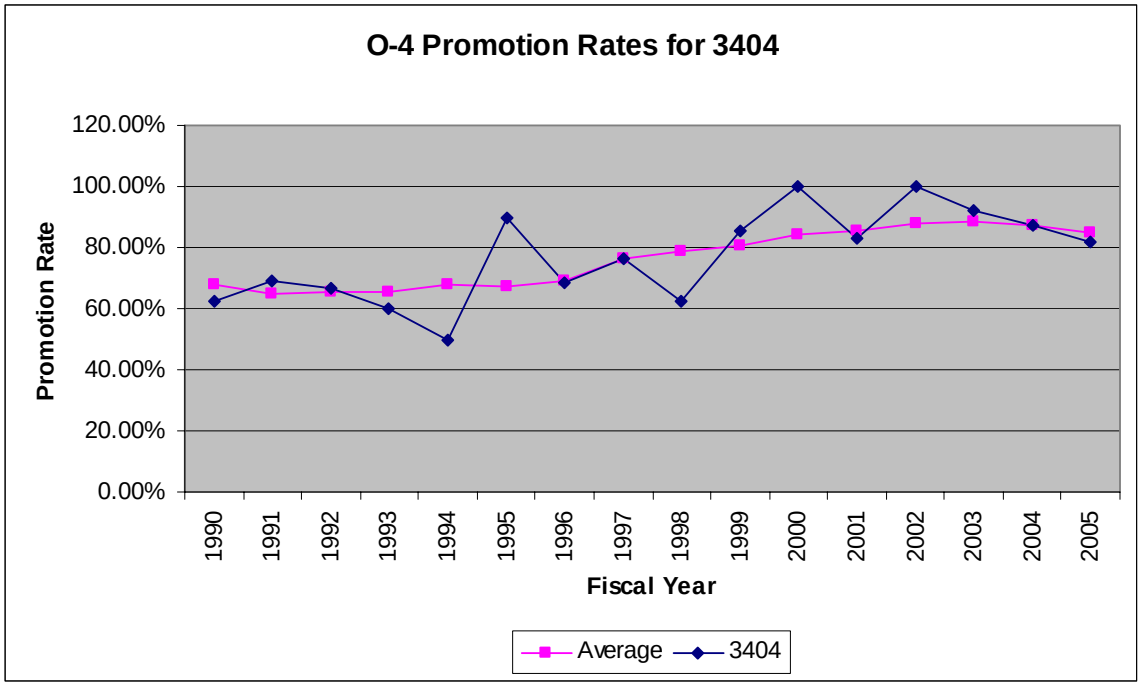
(Source: Author, 2006)



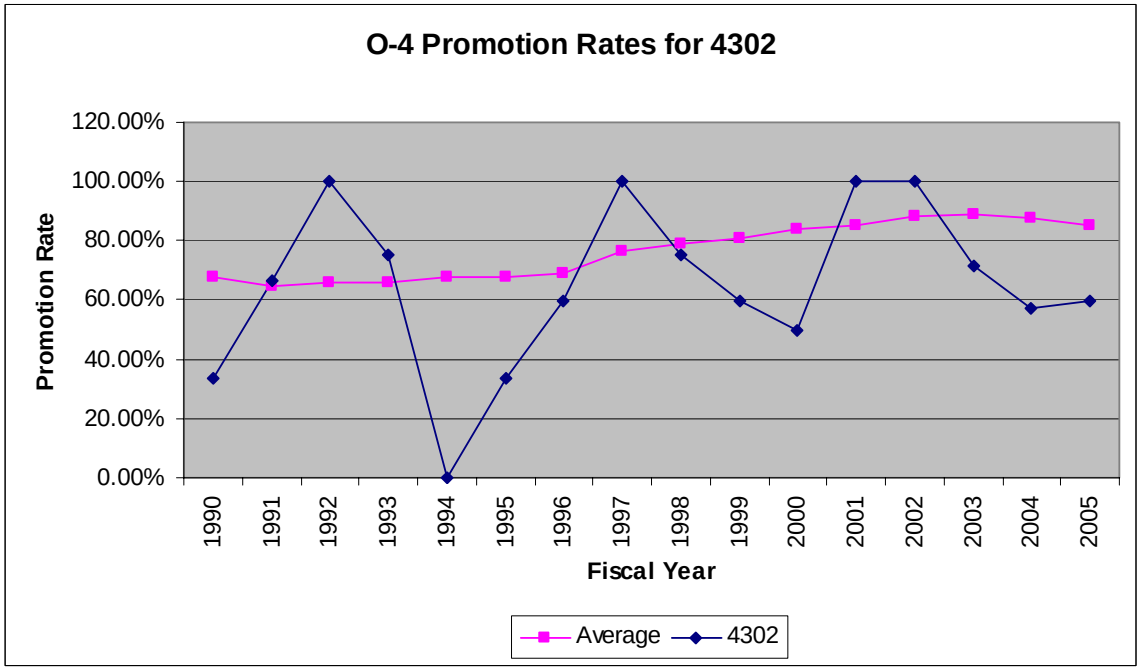
(Source: Author, 2006)



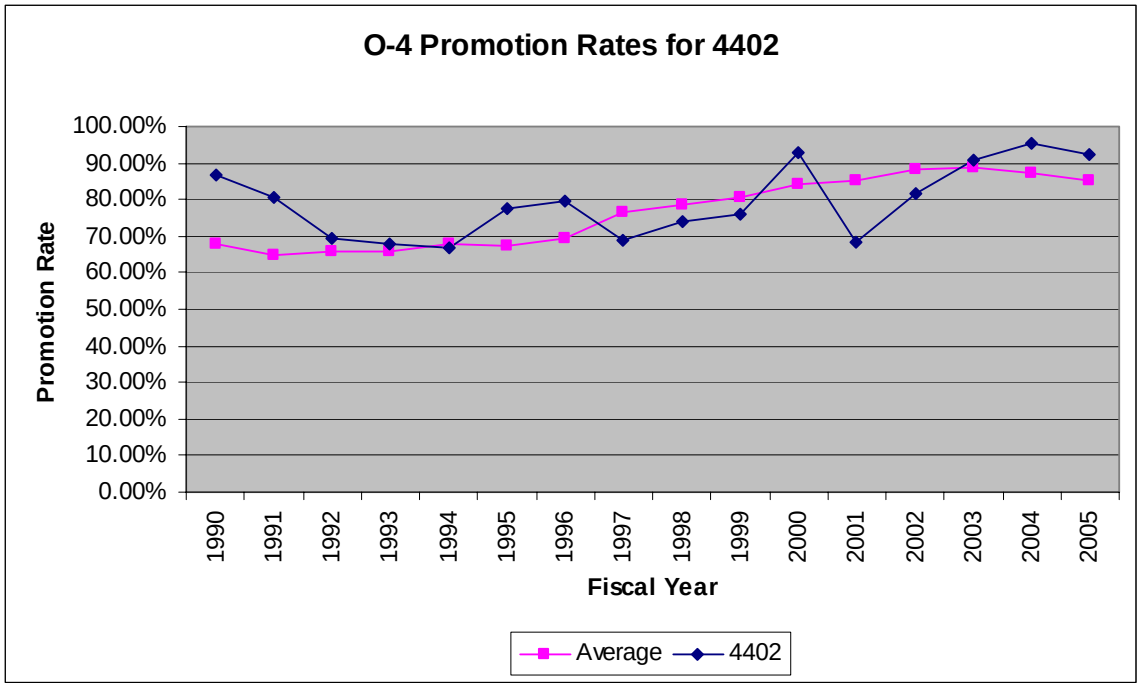
(Source: Author, 2006)



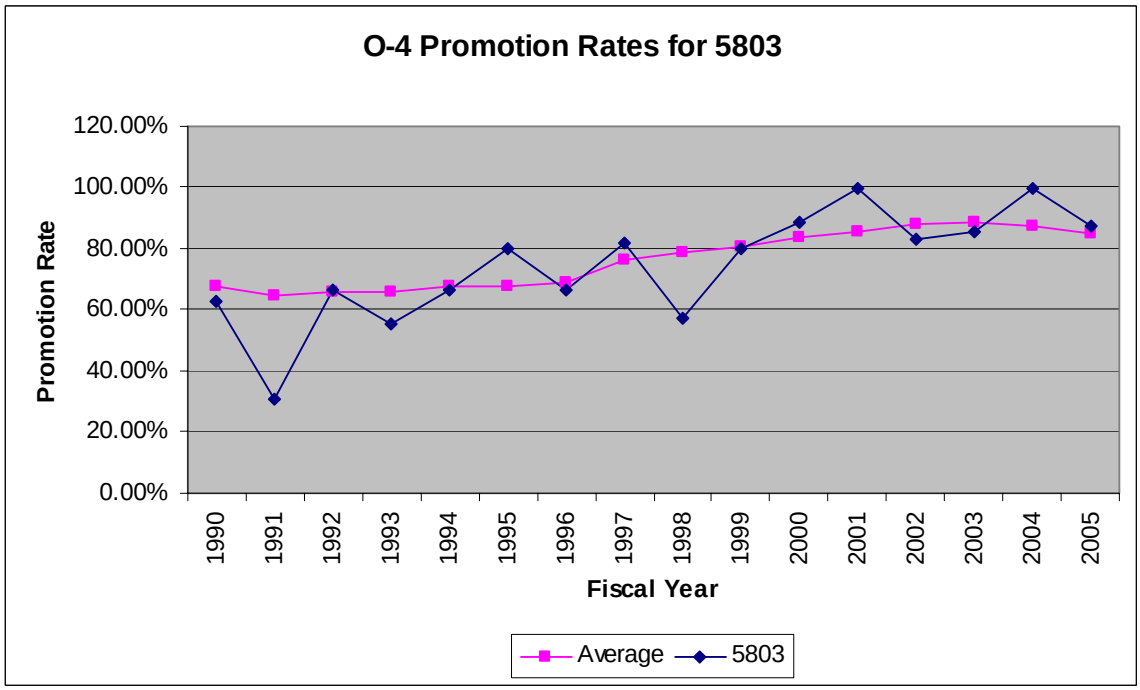
(Source: Author, 2006)



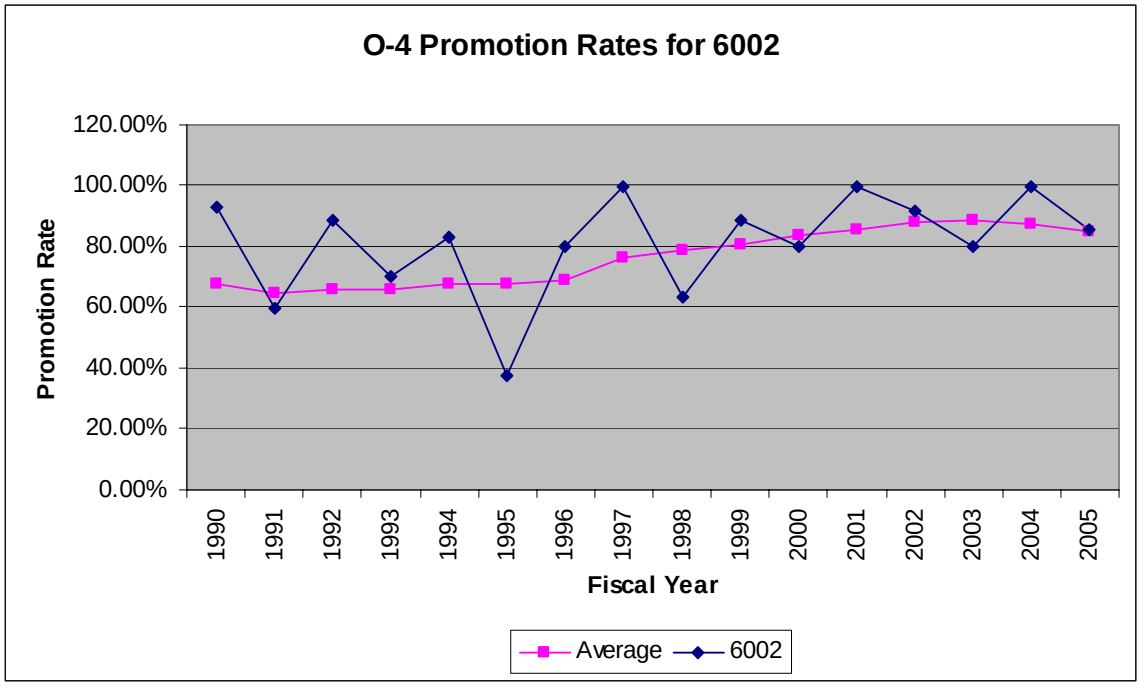
(Source: Author, 2006)



(Source: Author, 2006)



(Source: Author, 2006)



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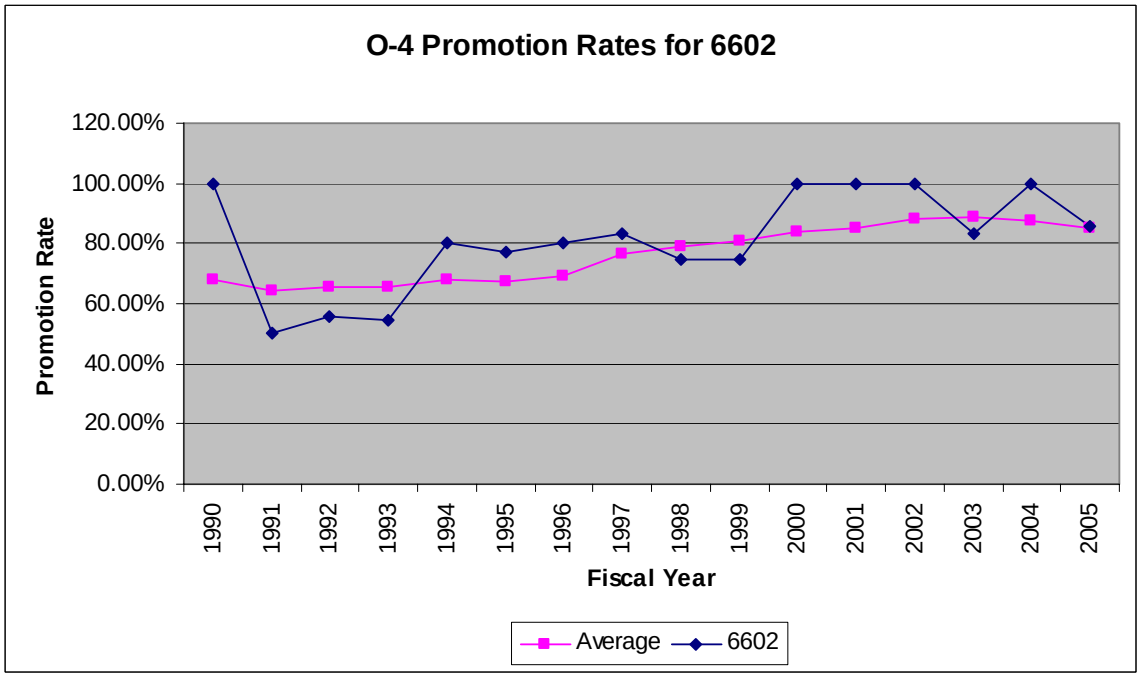

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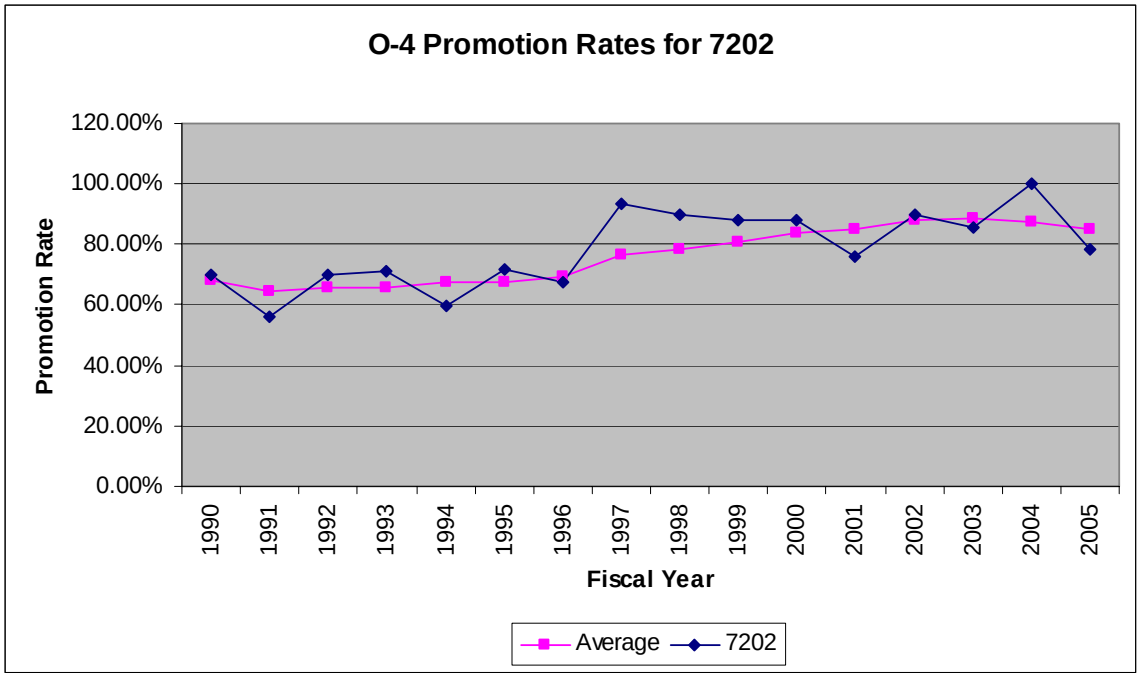

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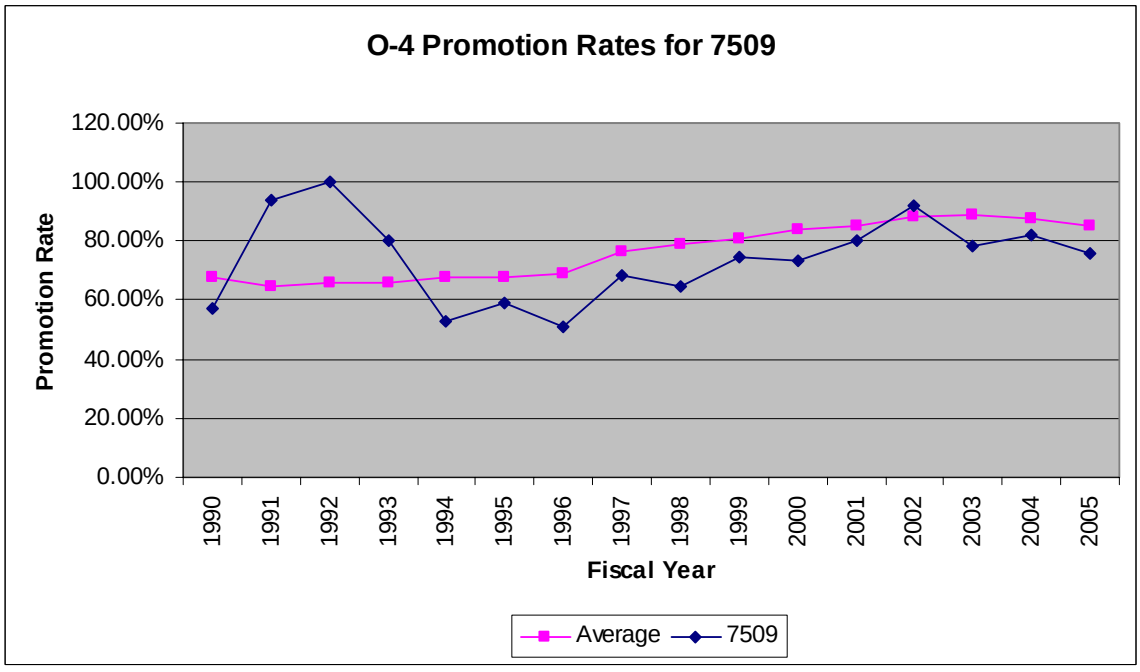

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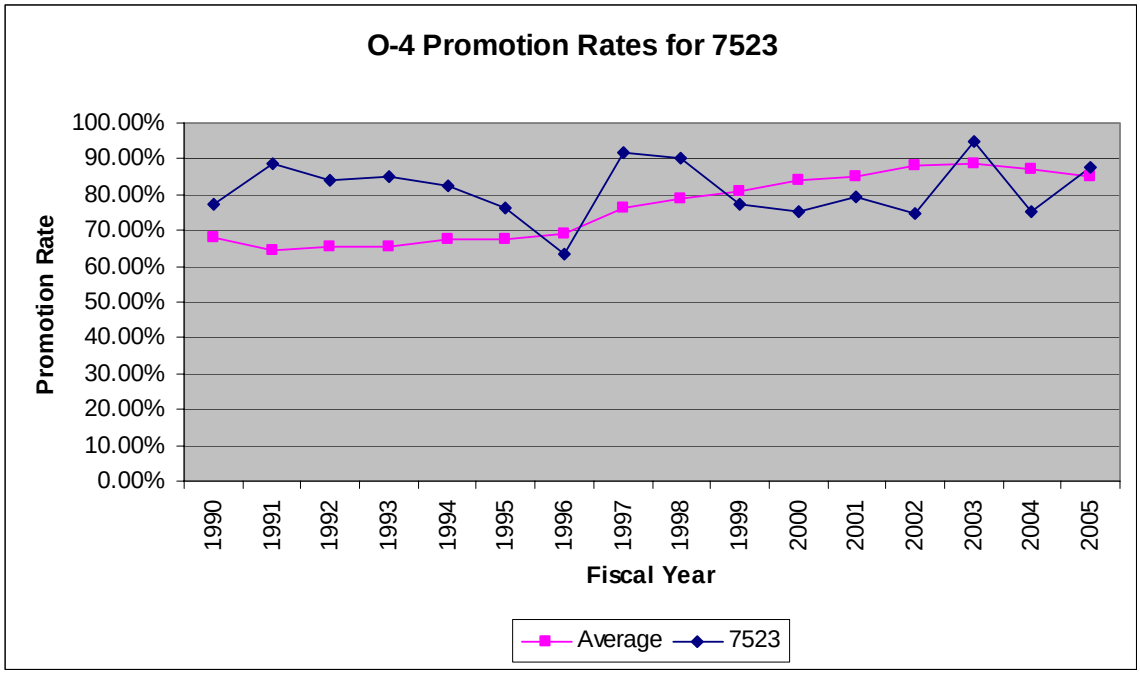

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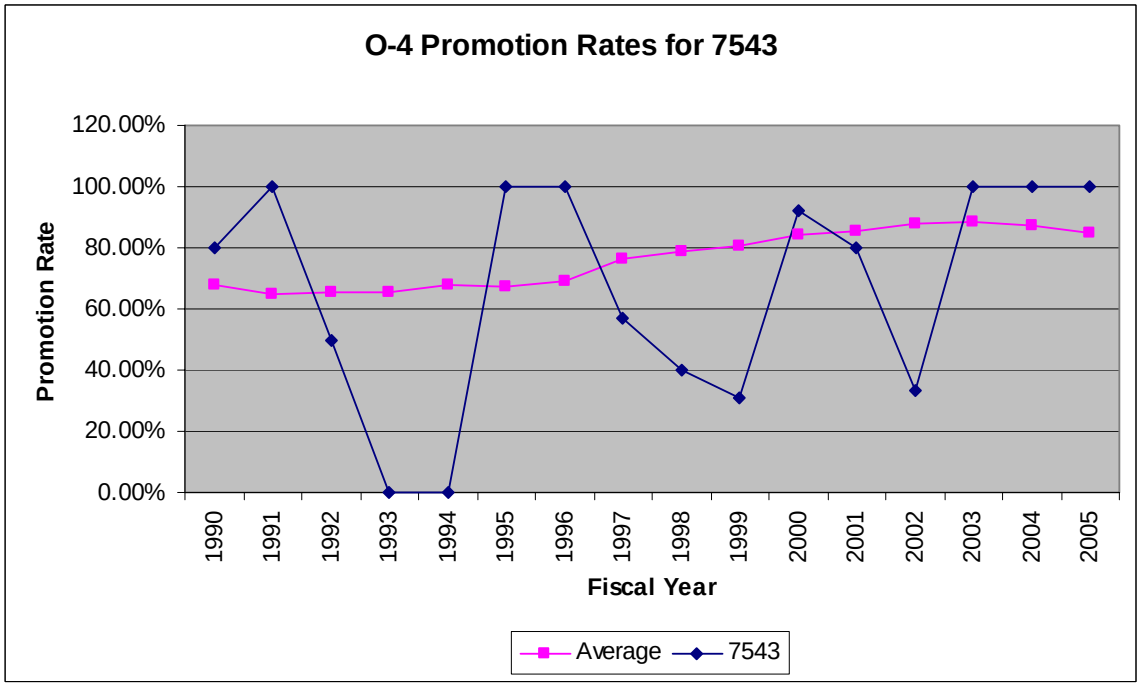

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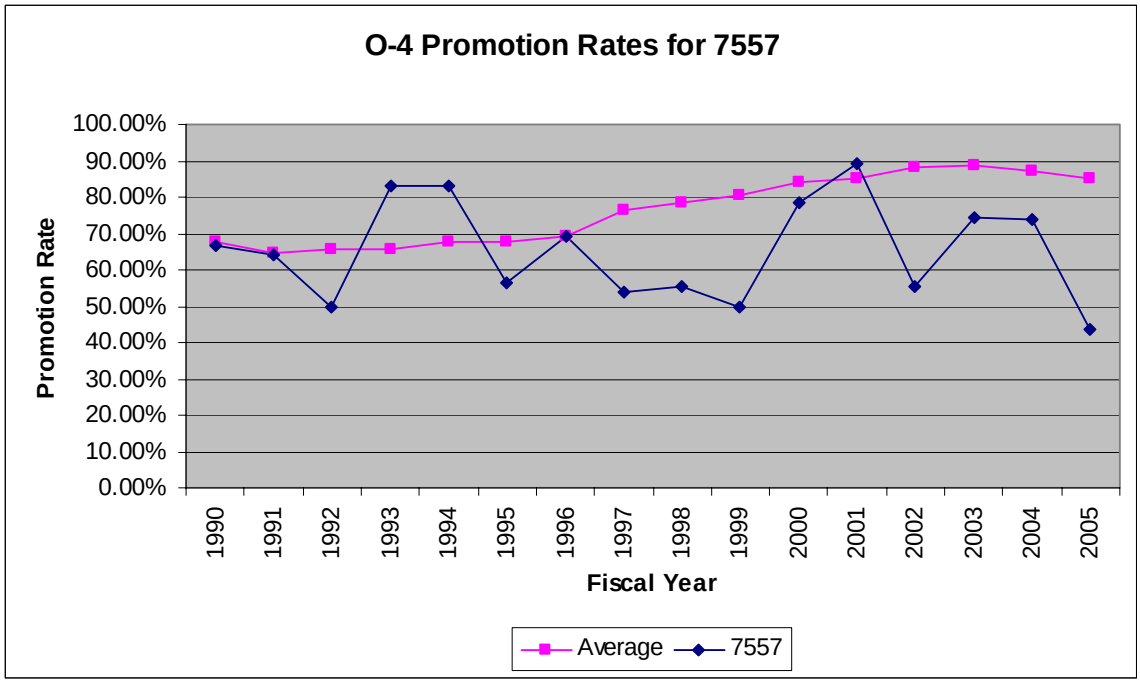

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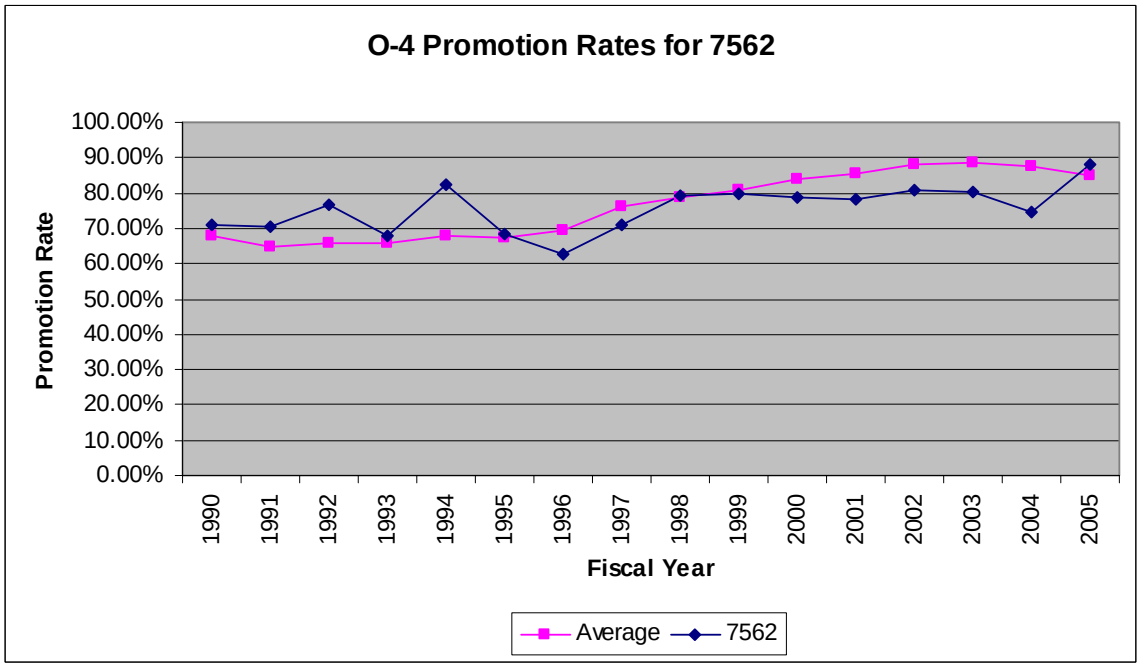

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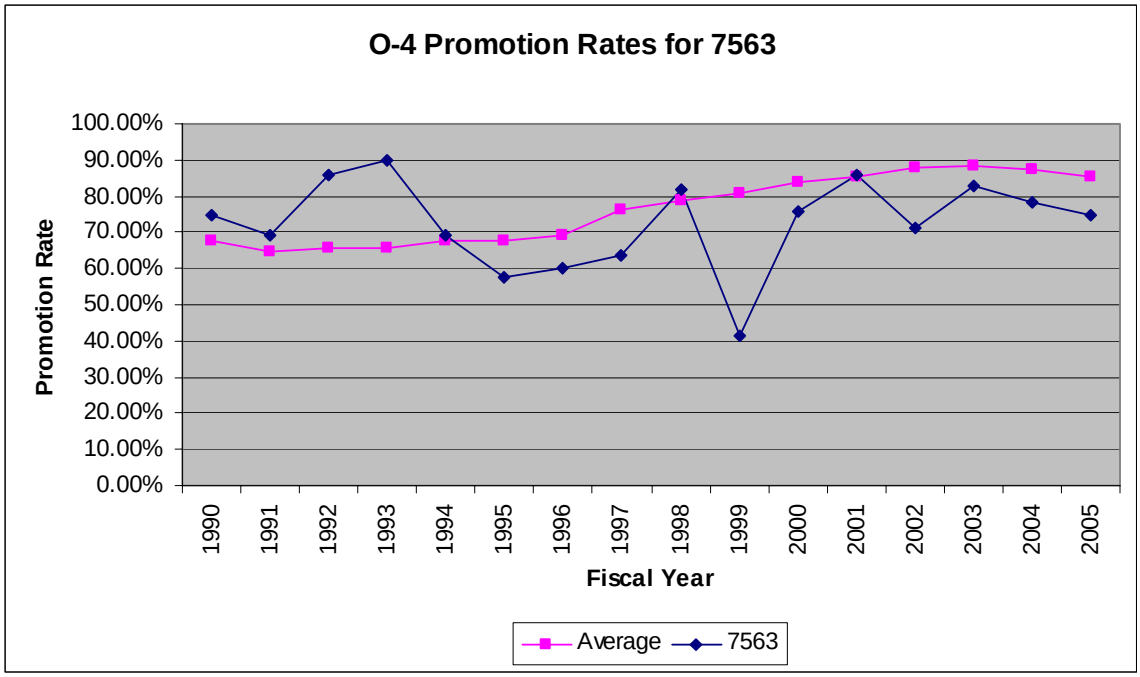

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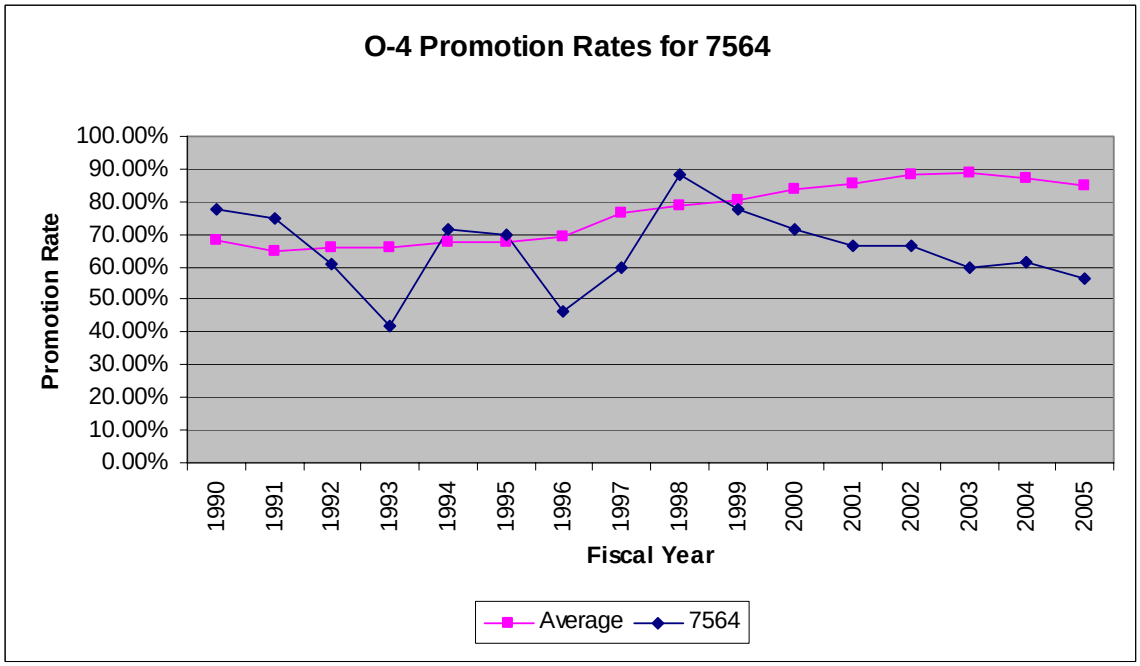

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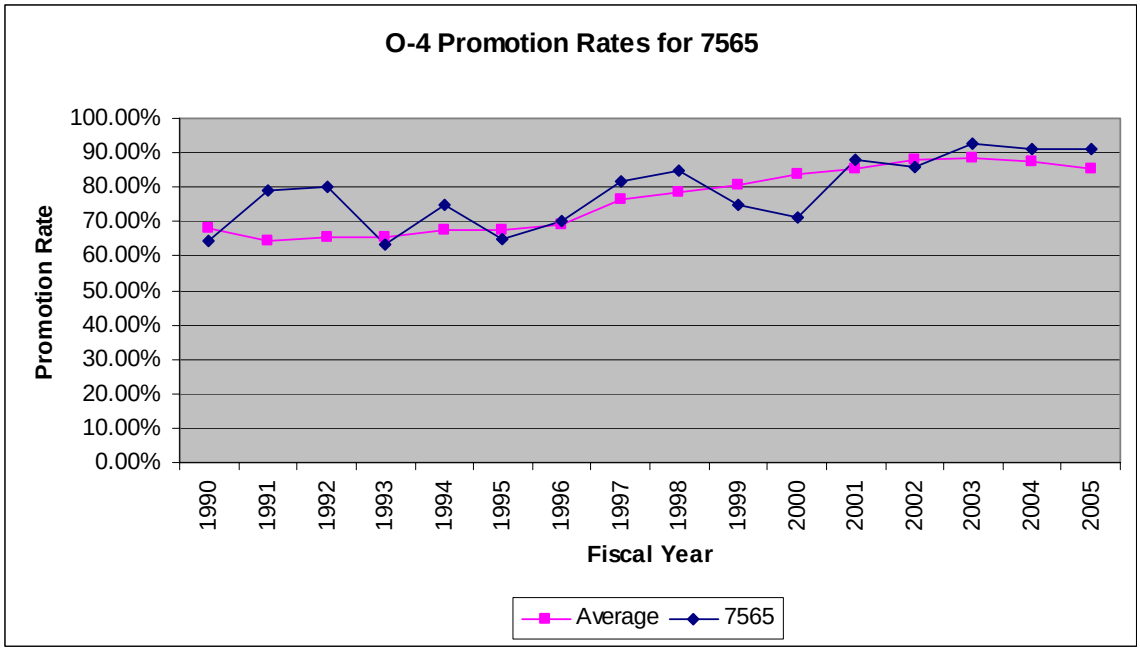

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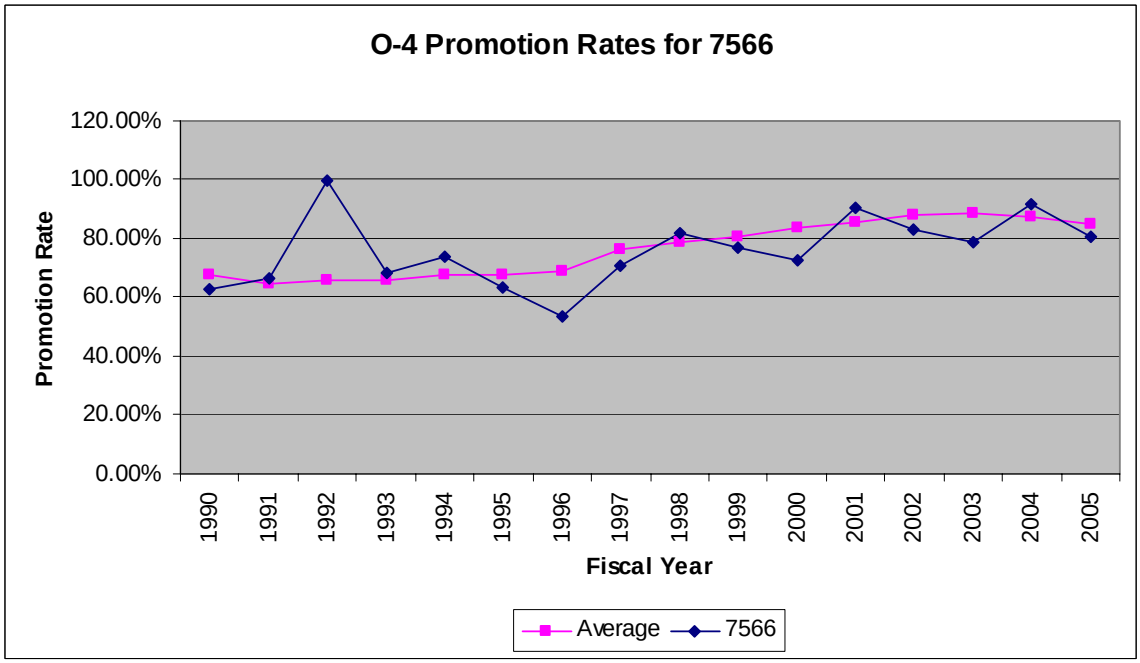

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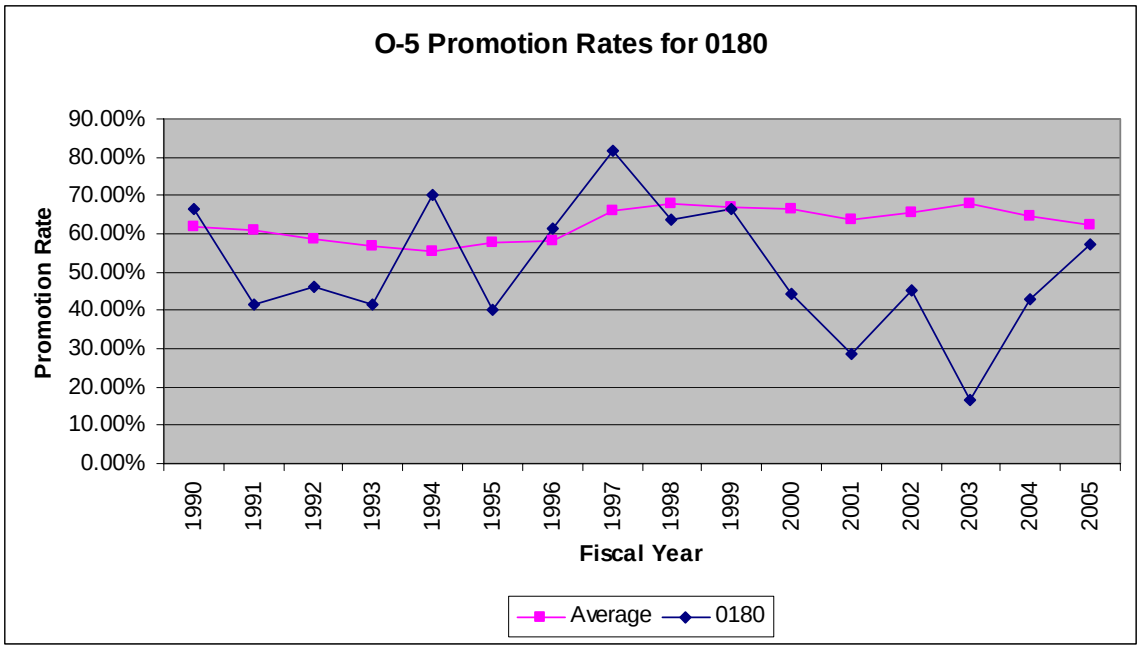
B. O-5 PROMOTION RATES BY PMOS



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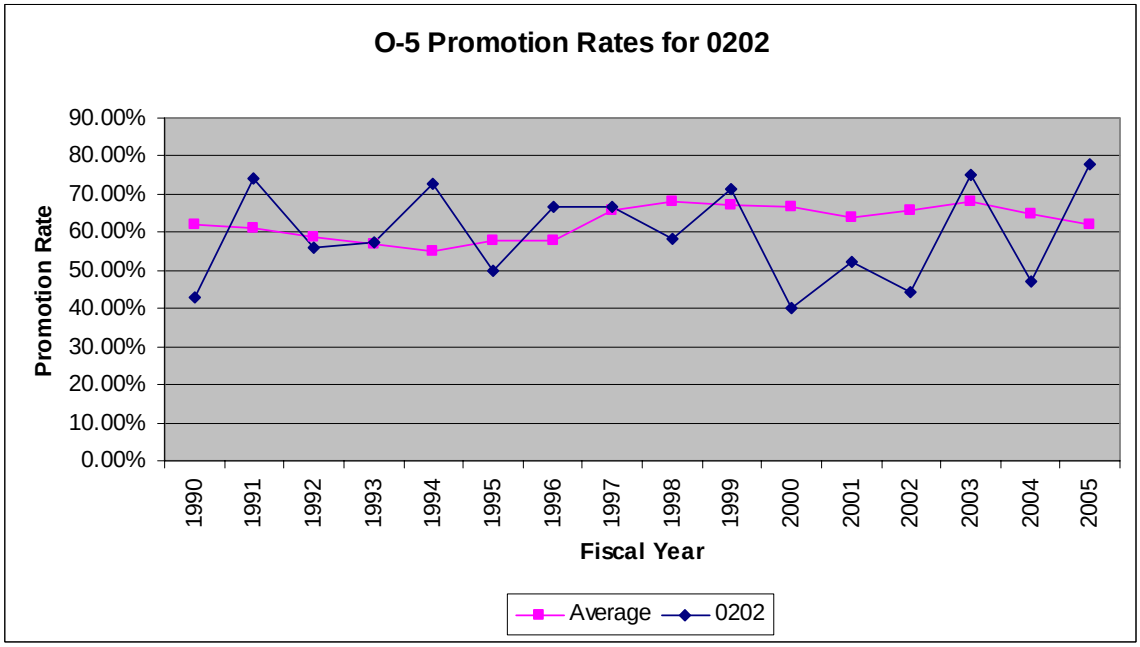

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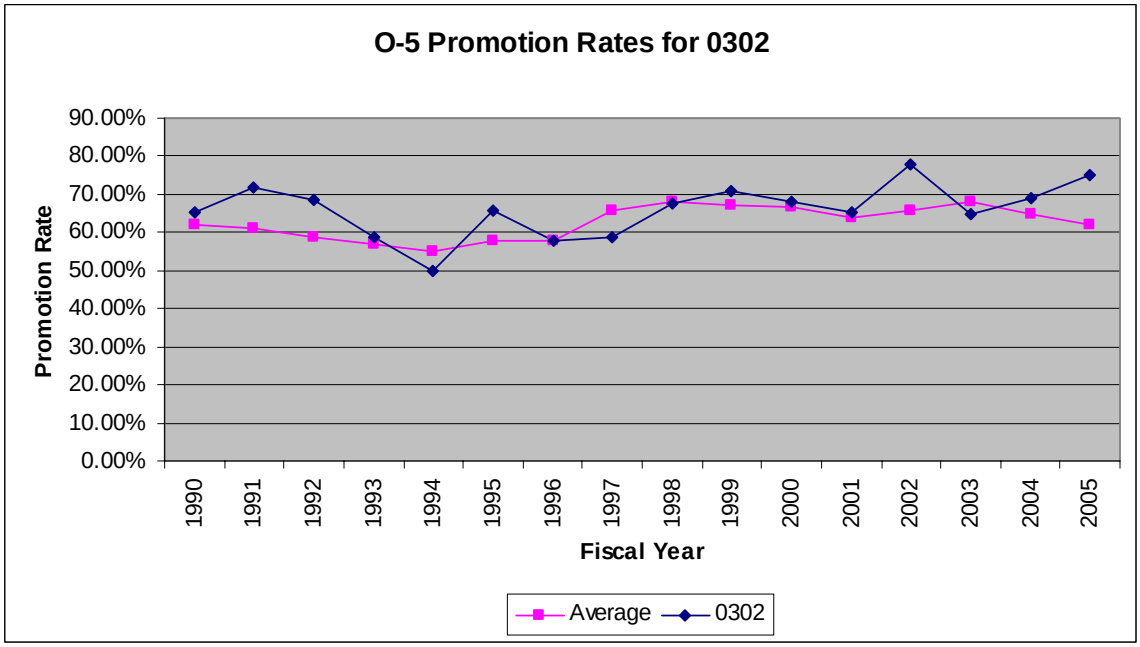

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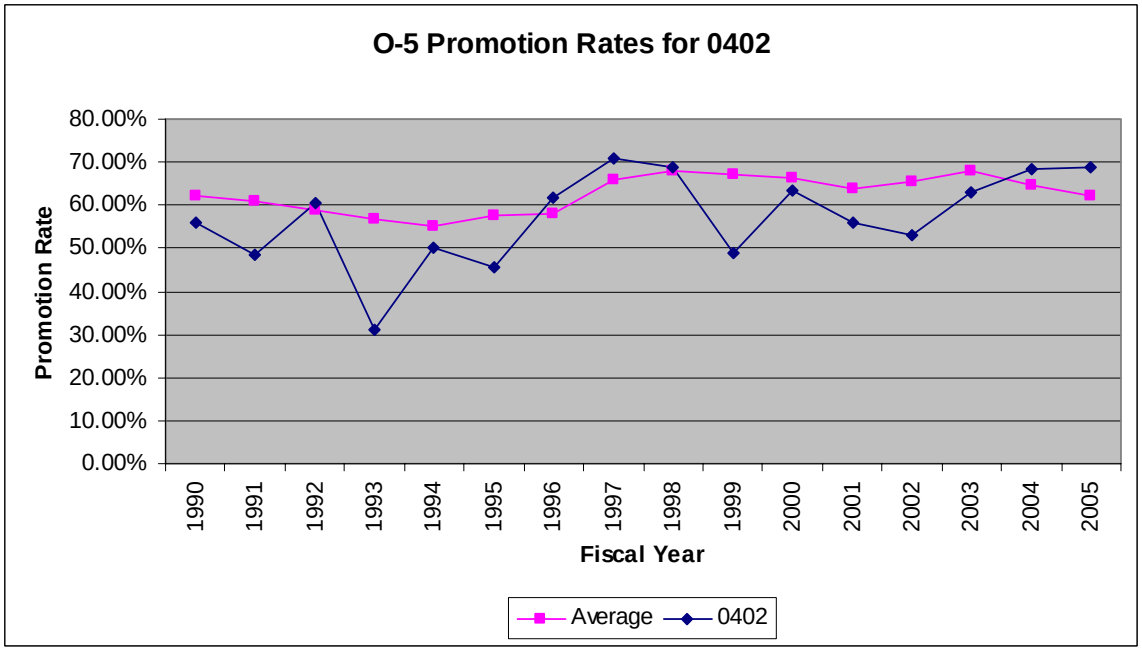

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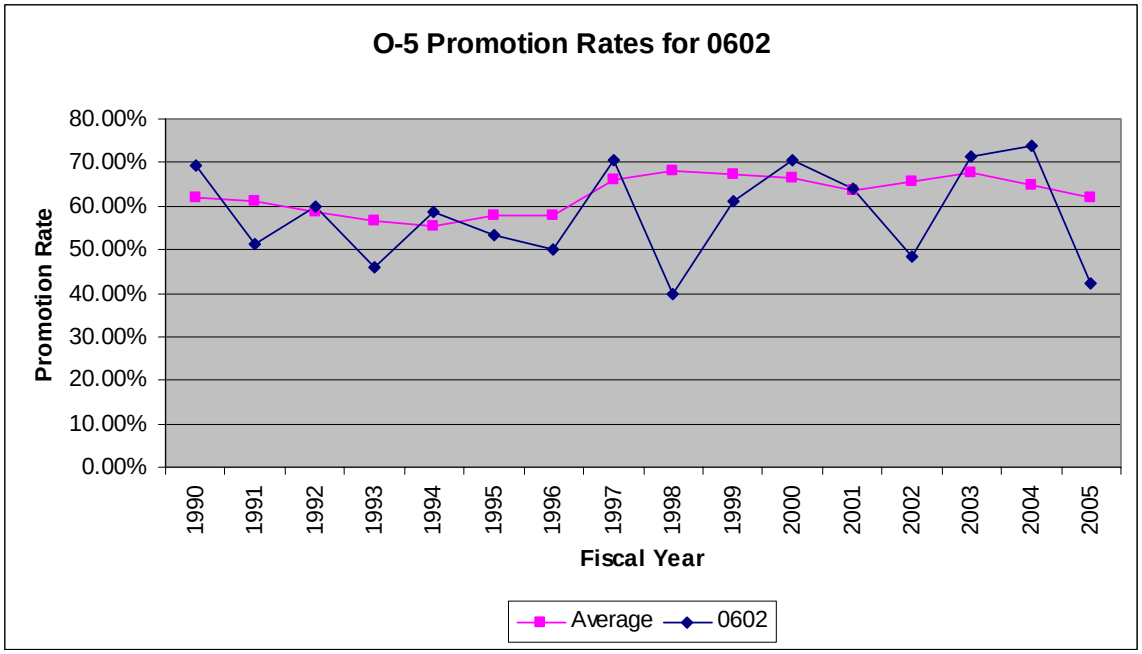

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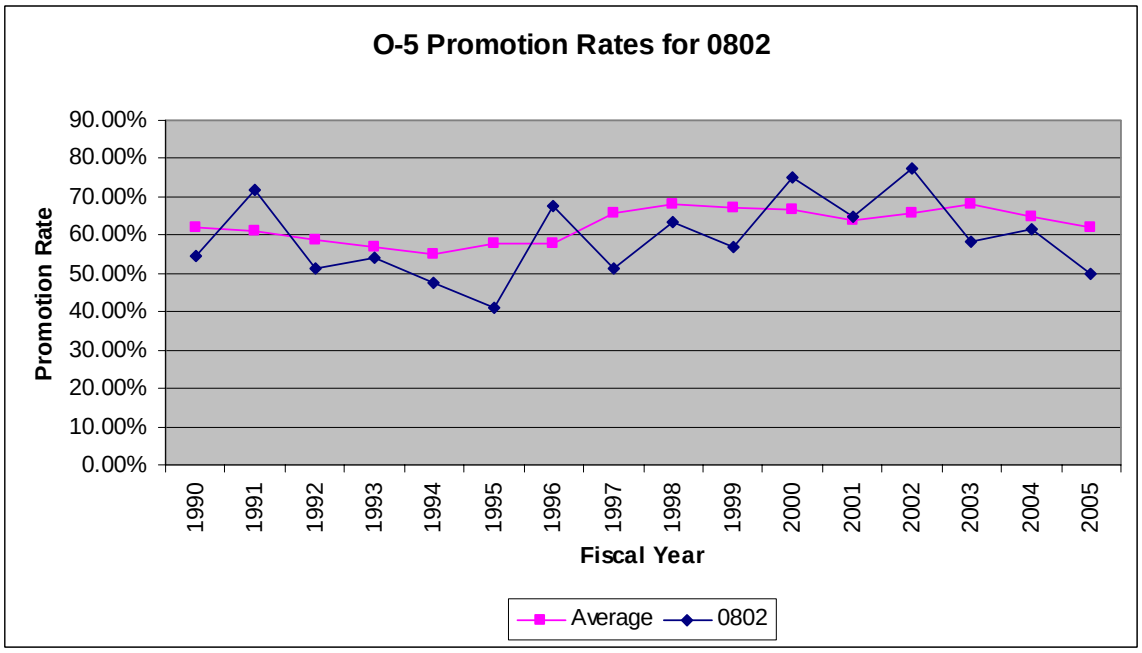

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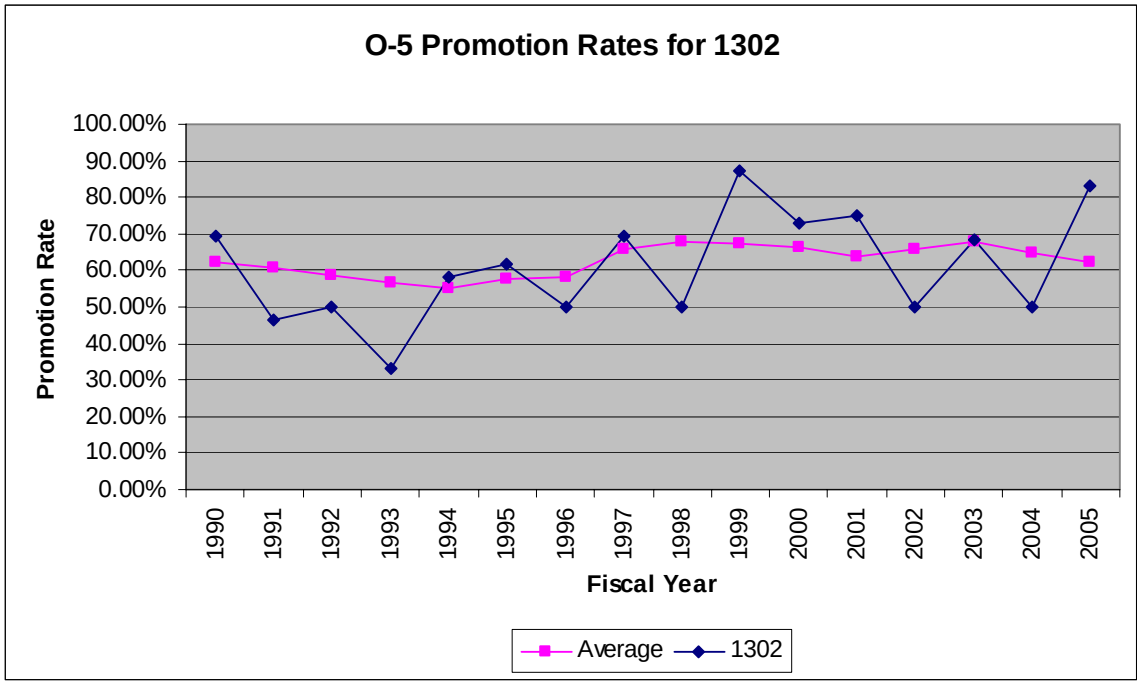

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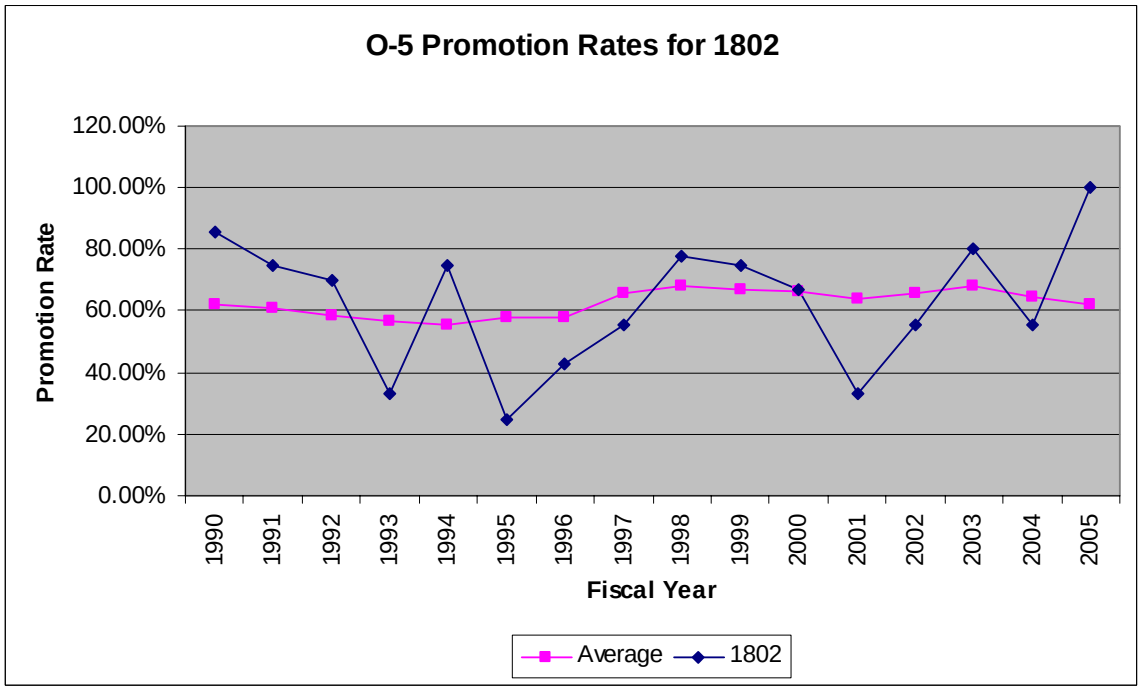

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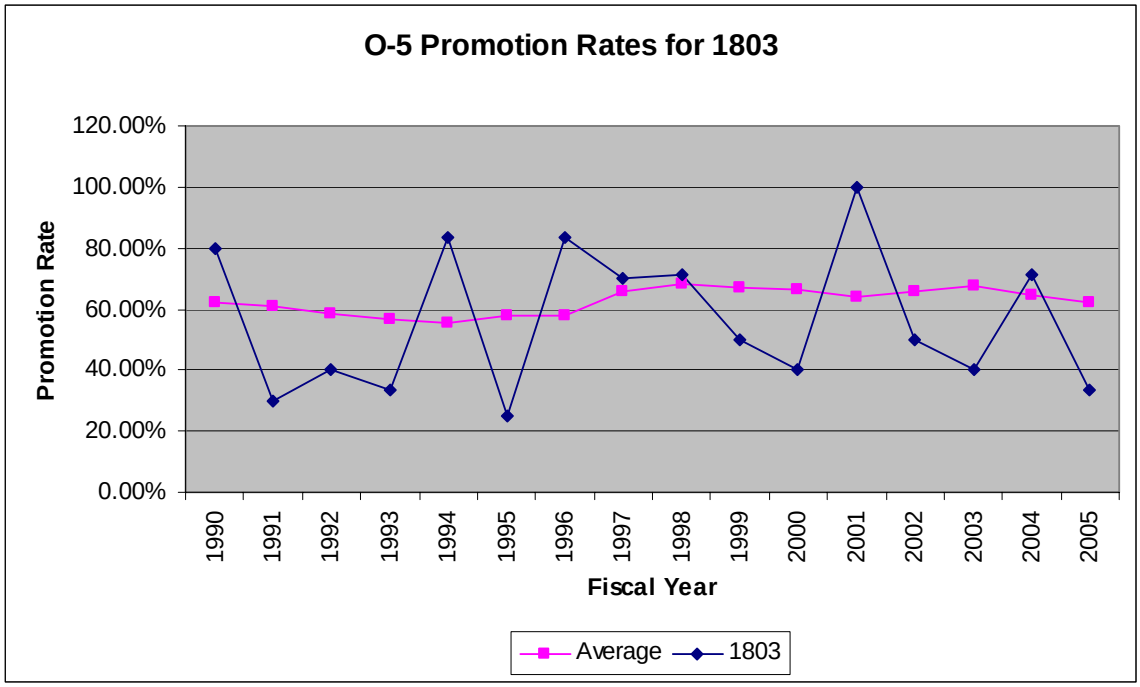

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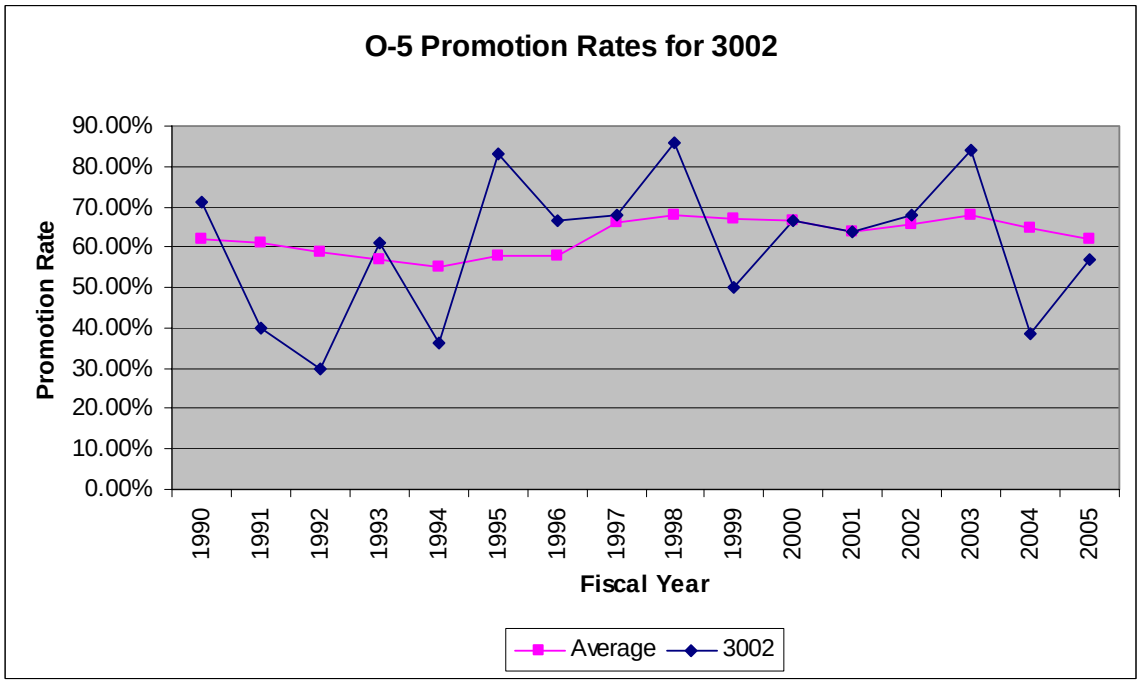

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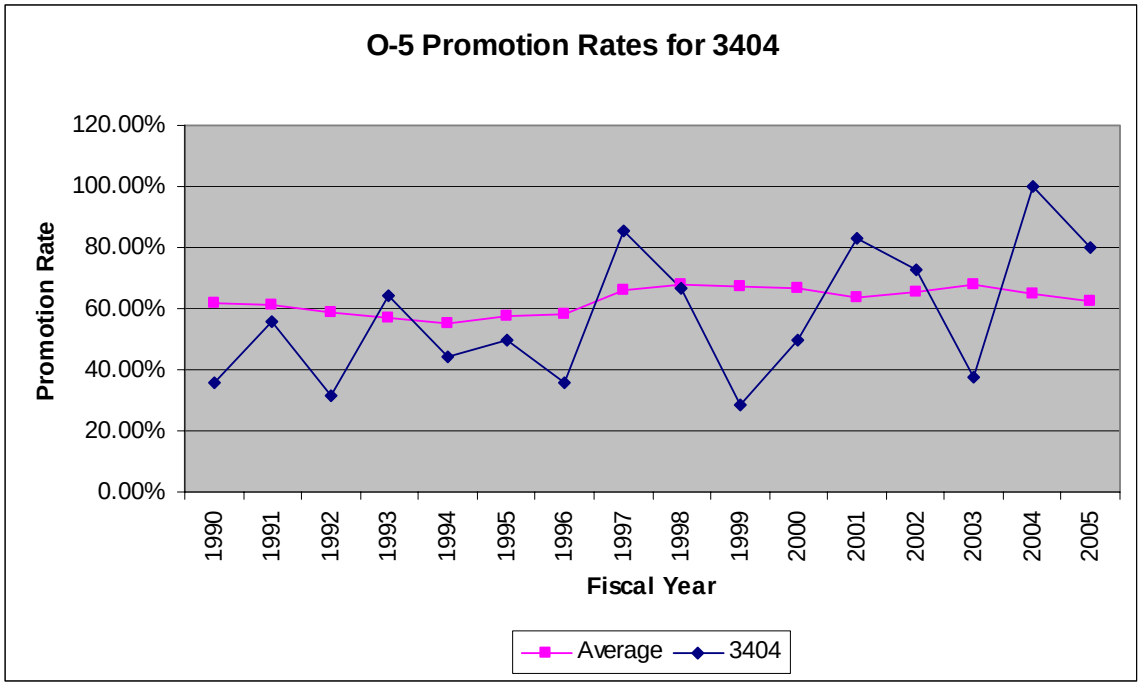

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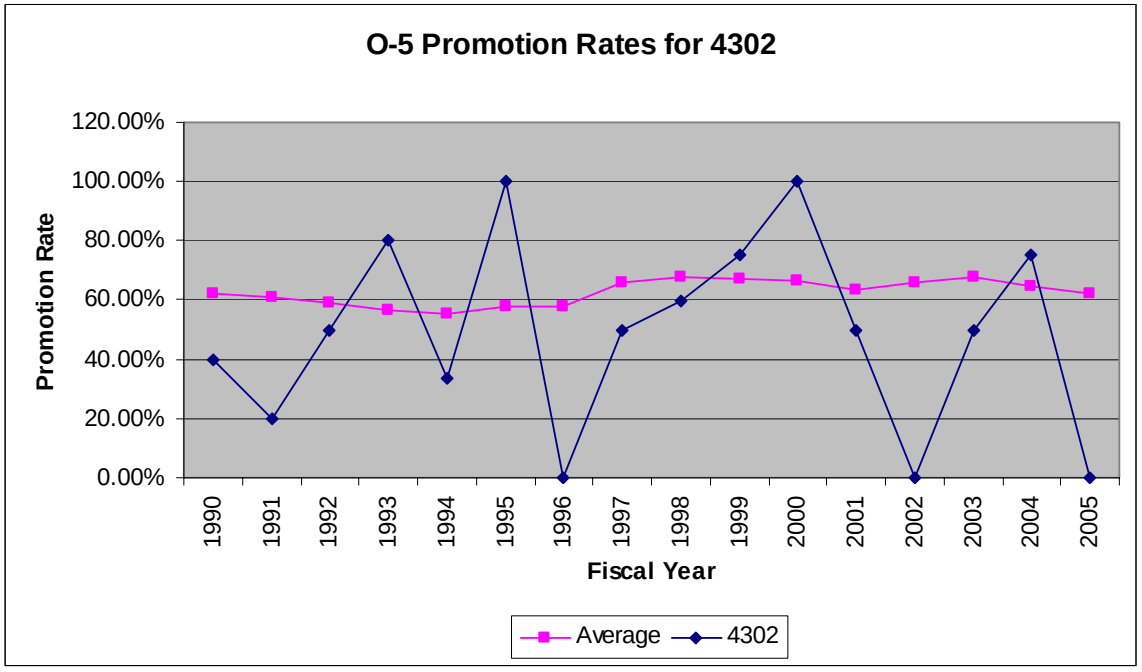

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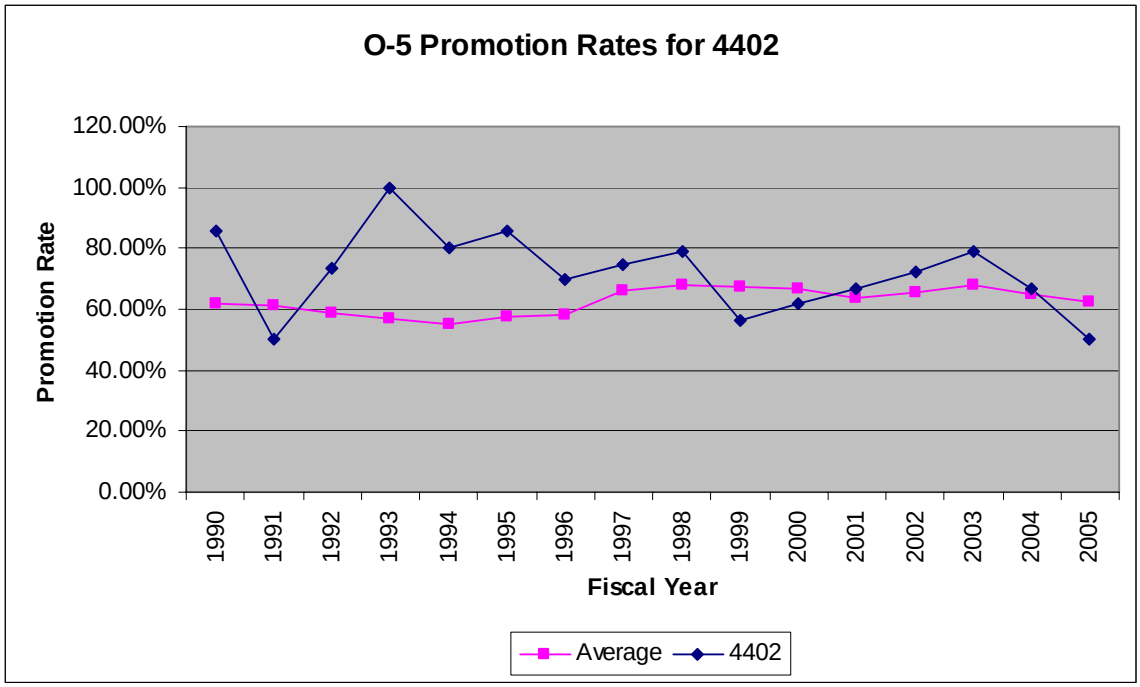

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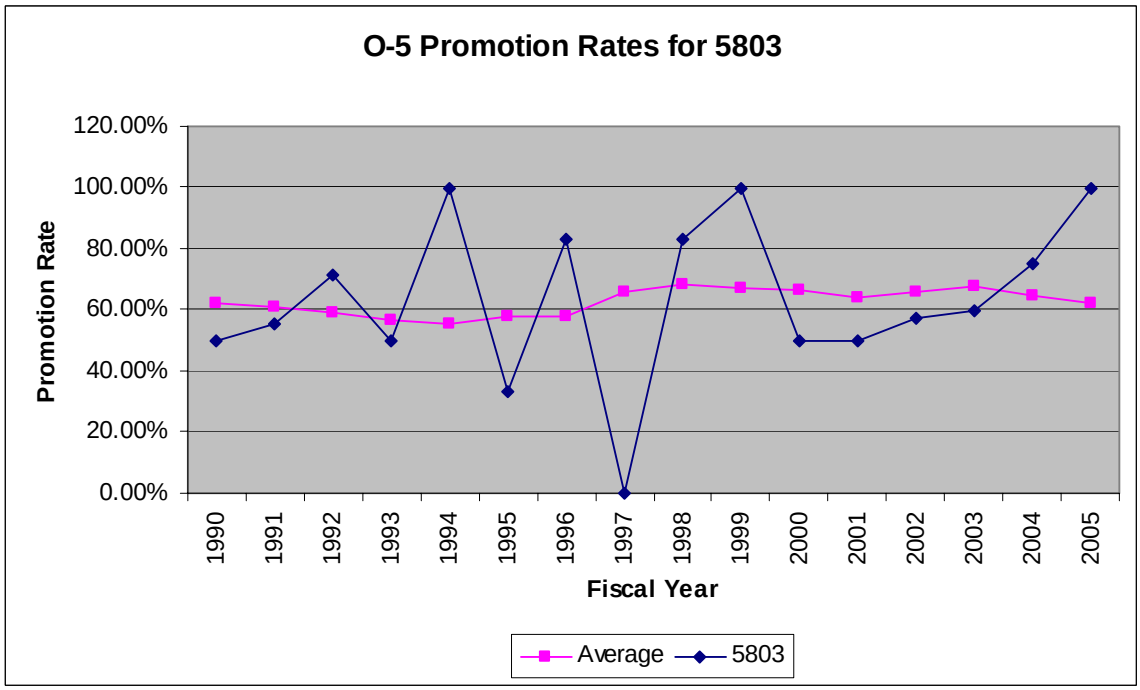

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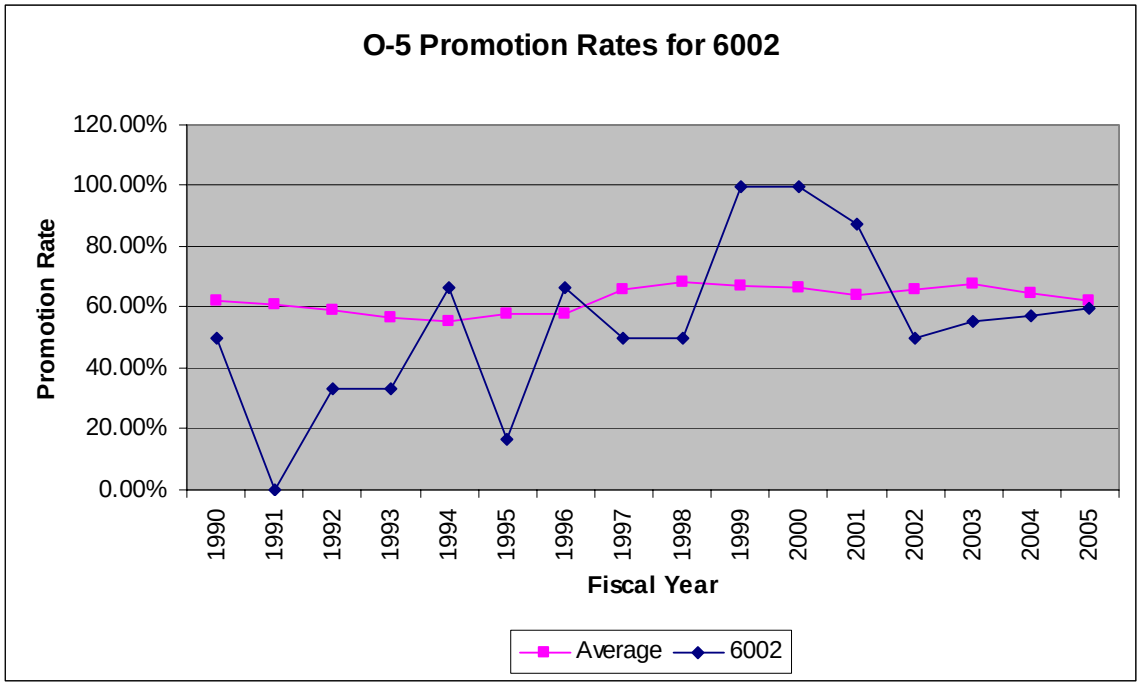

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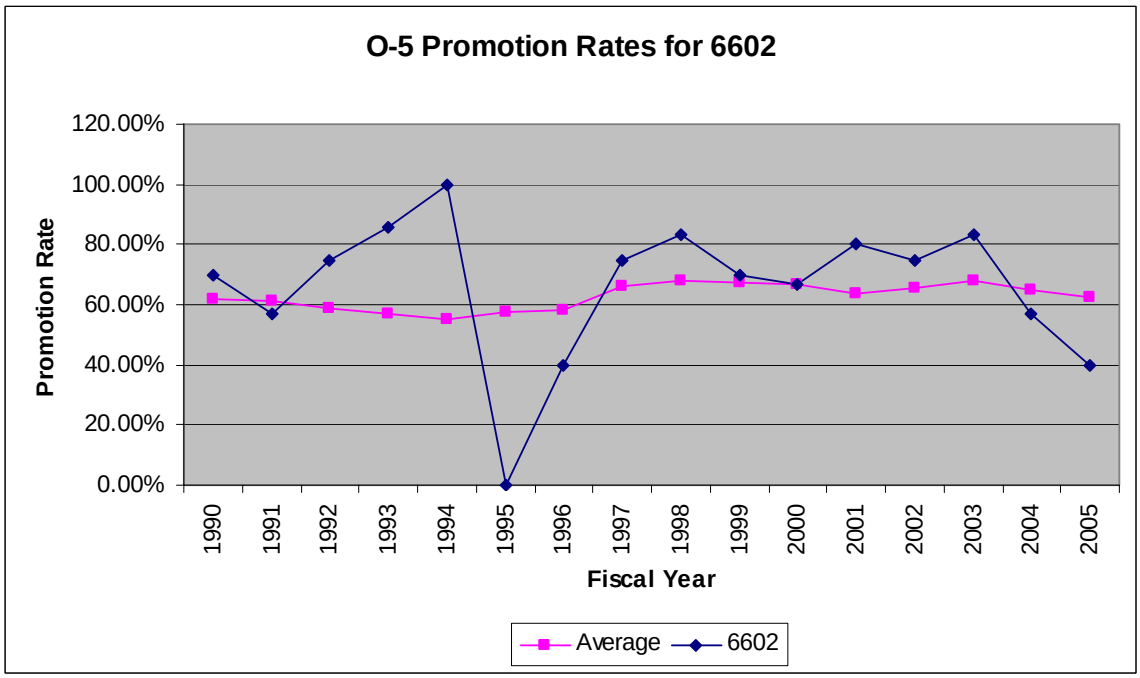

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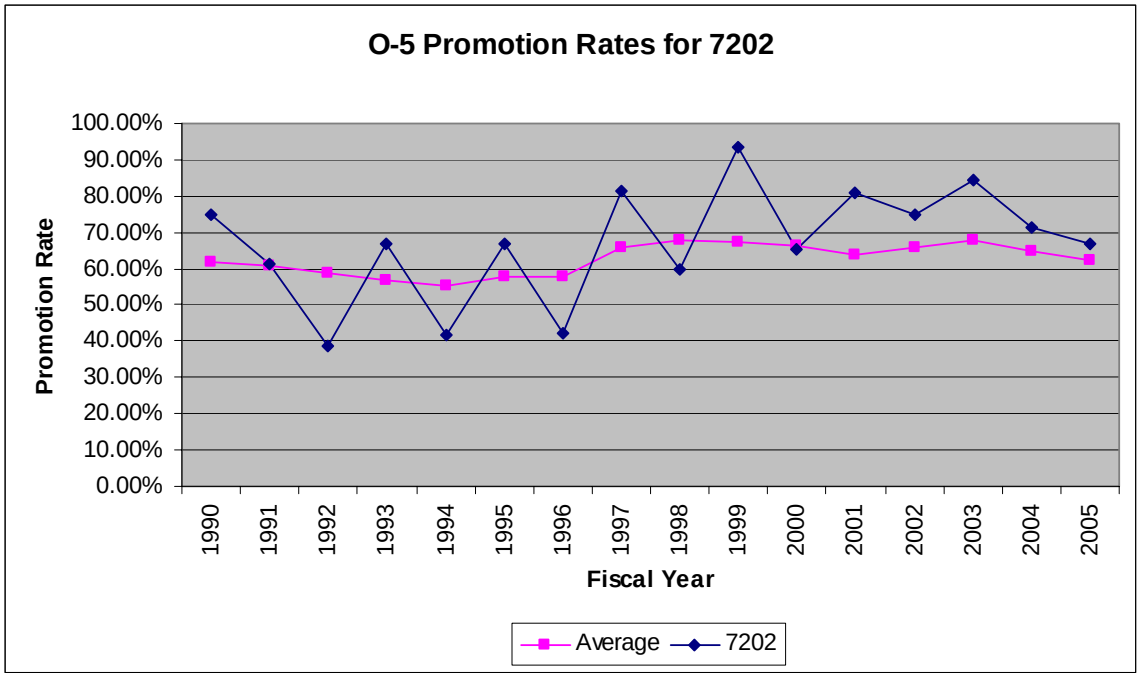

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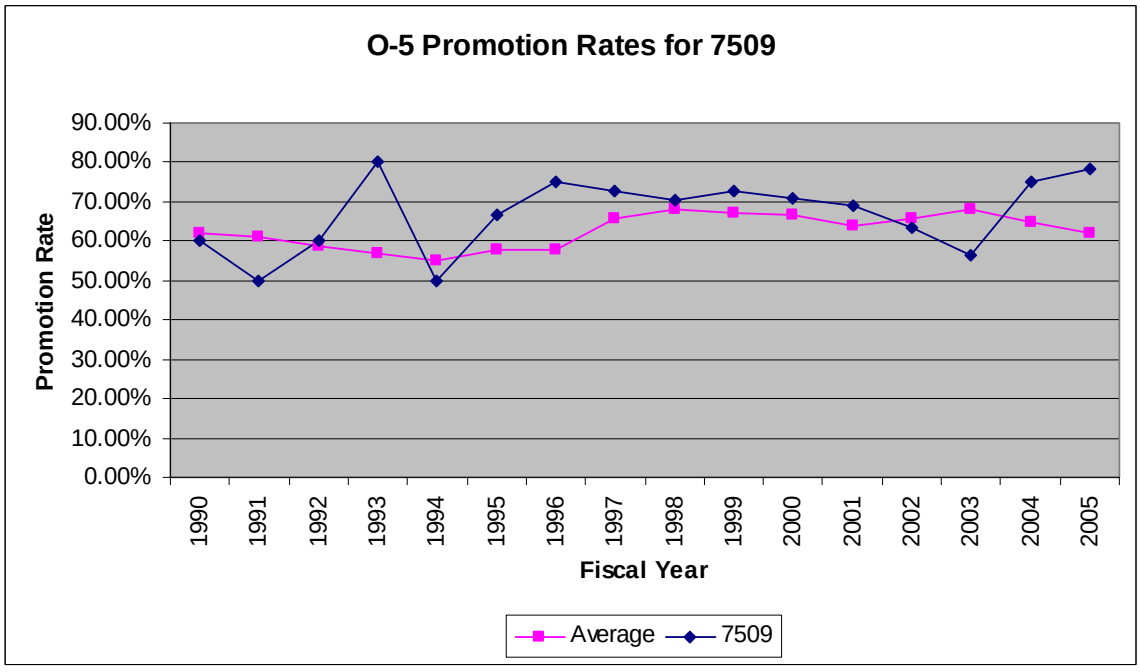

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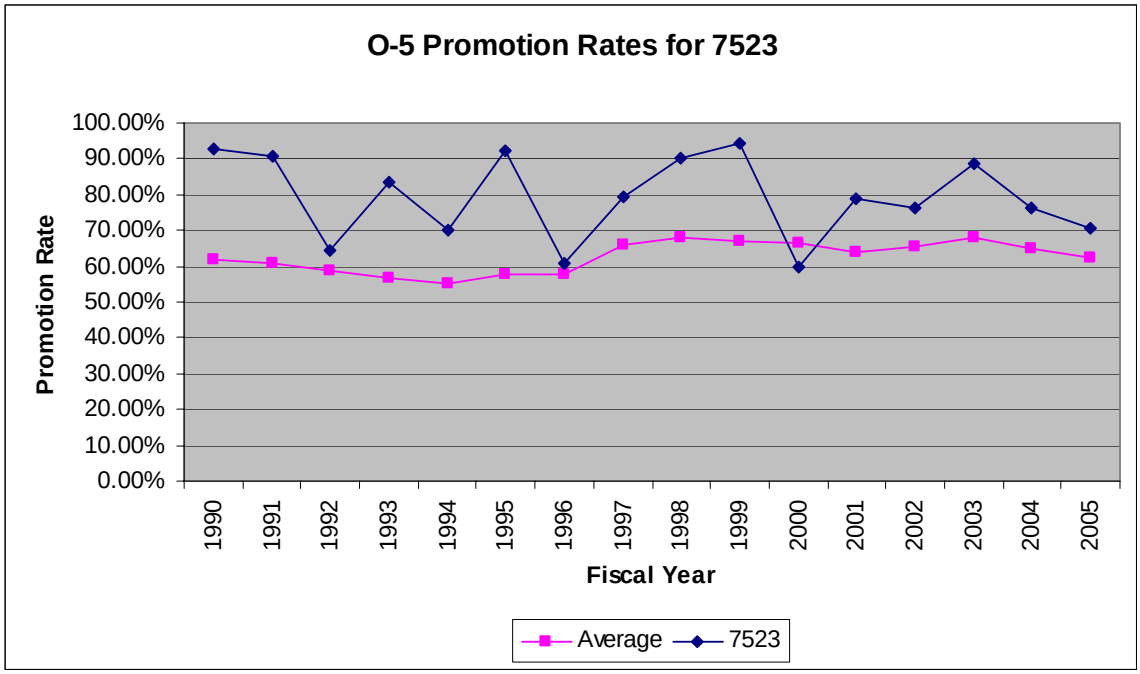

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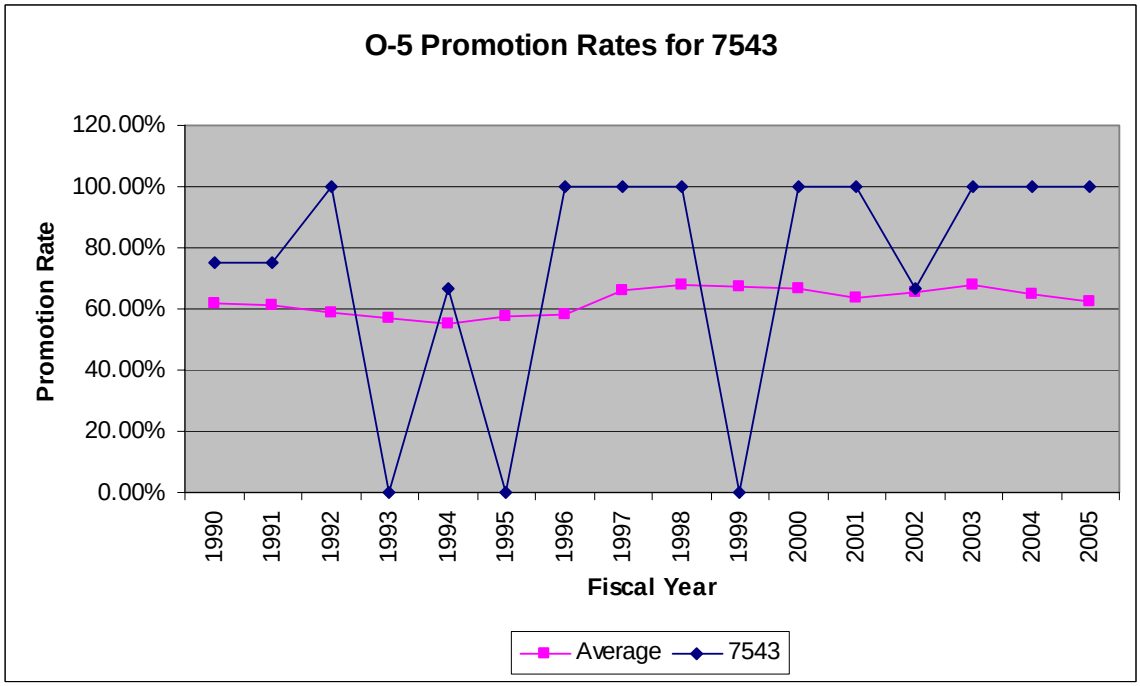

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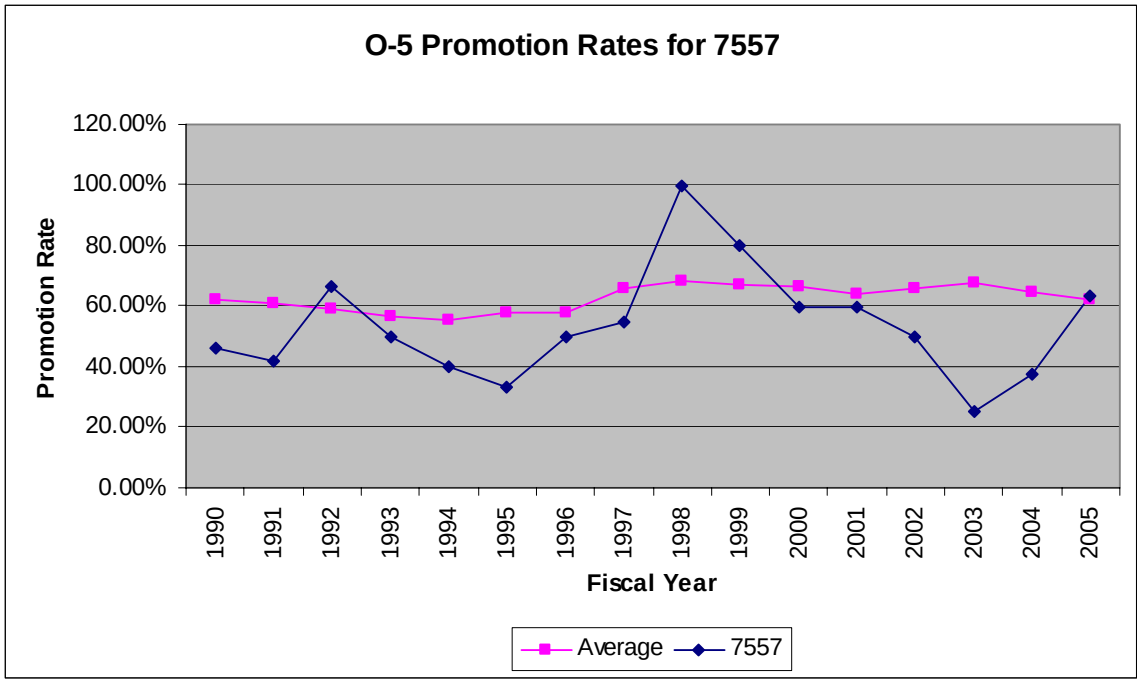

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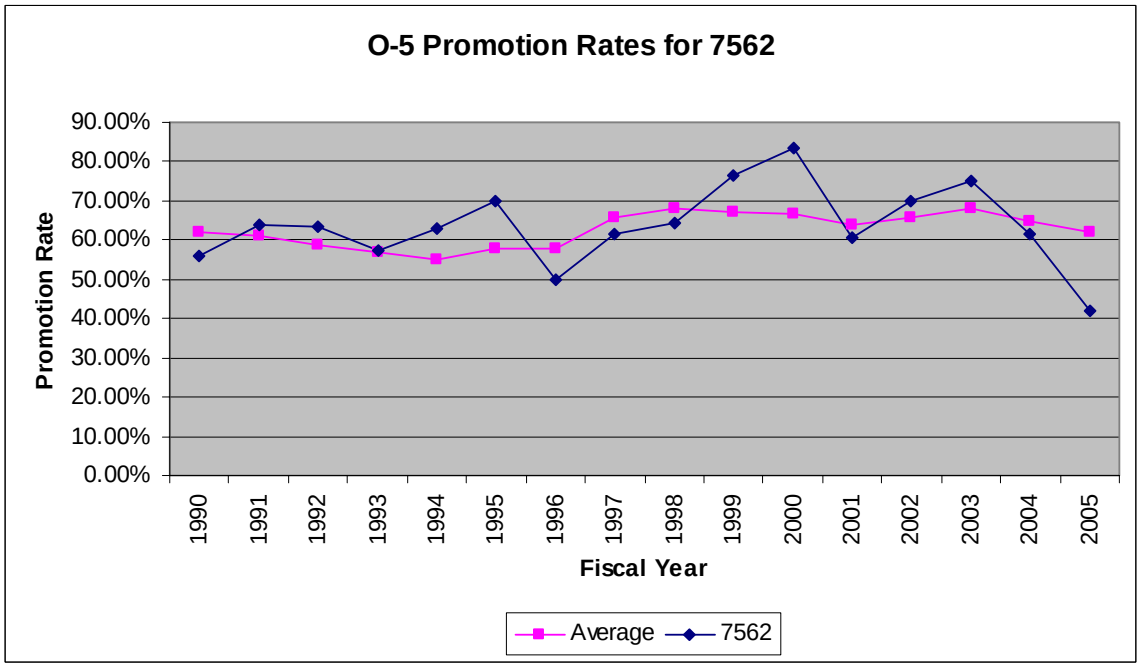

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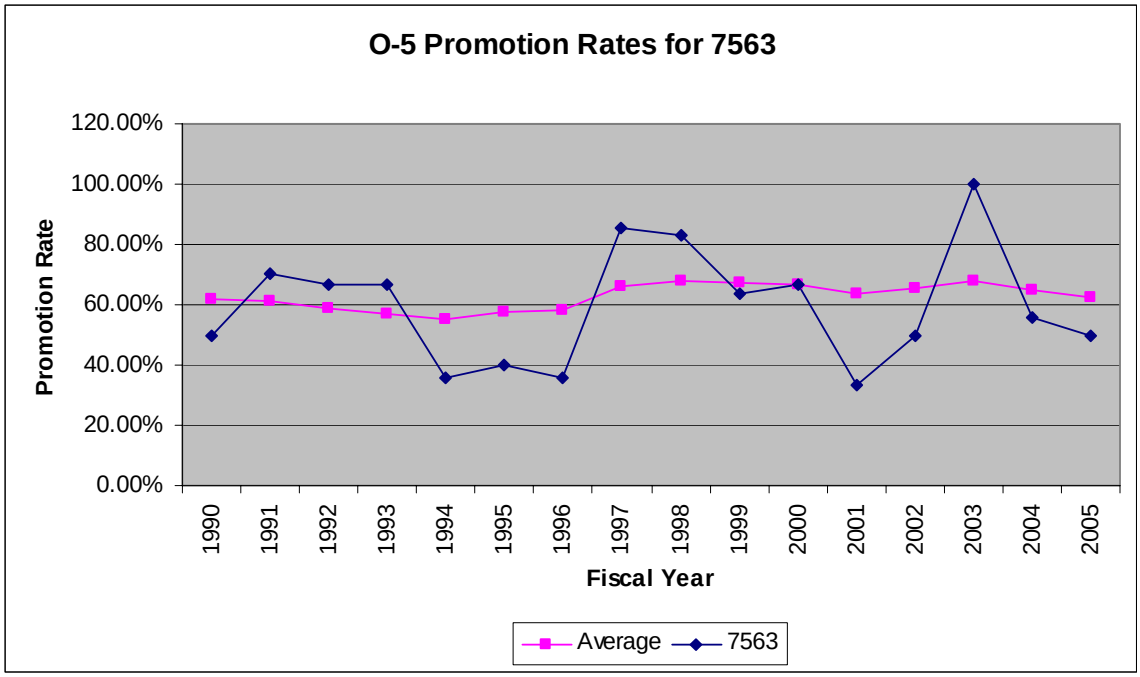

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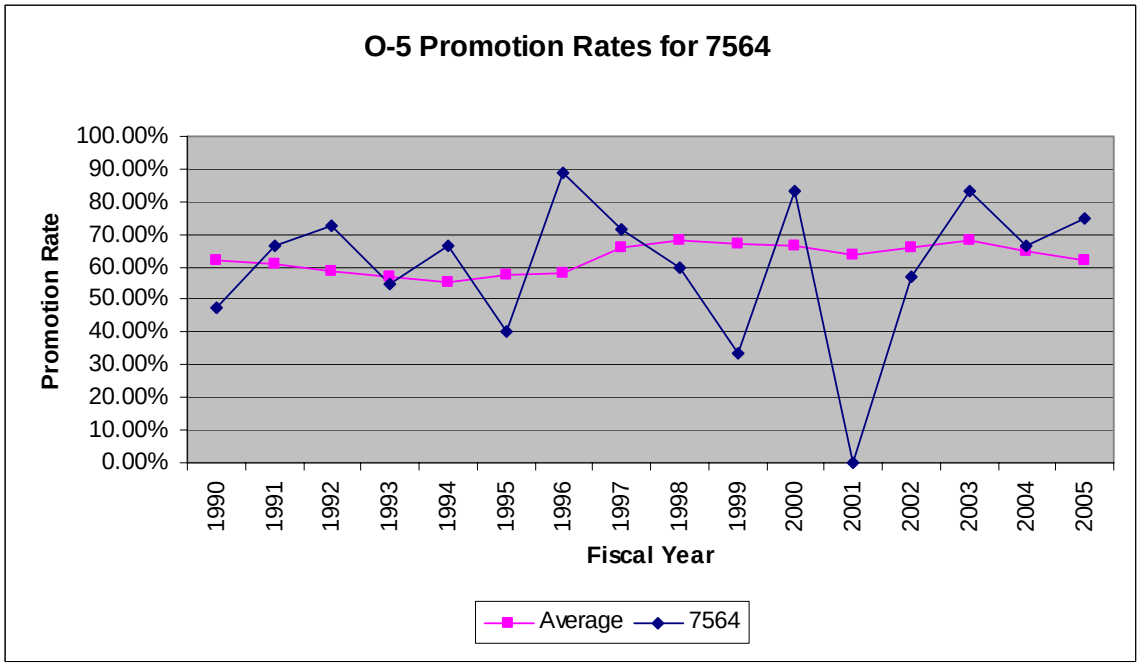

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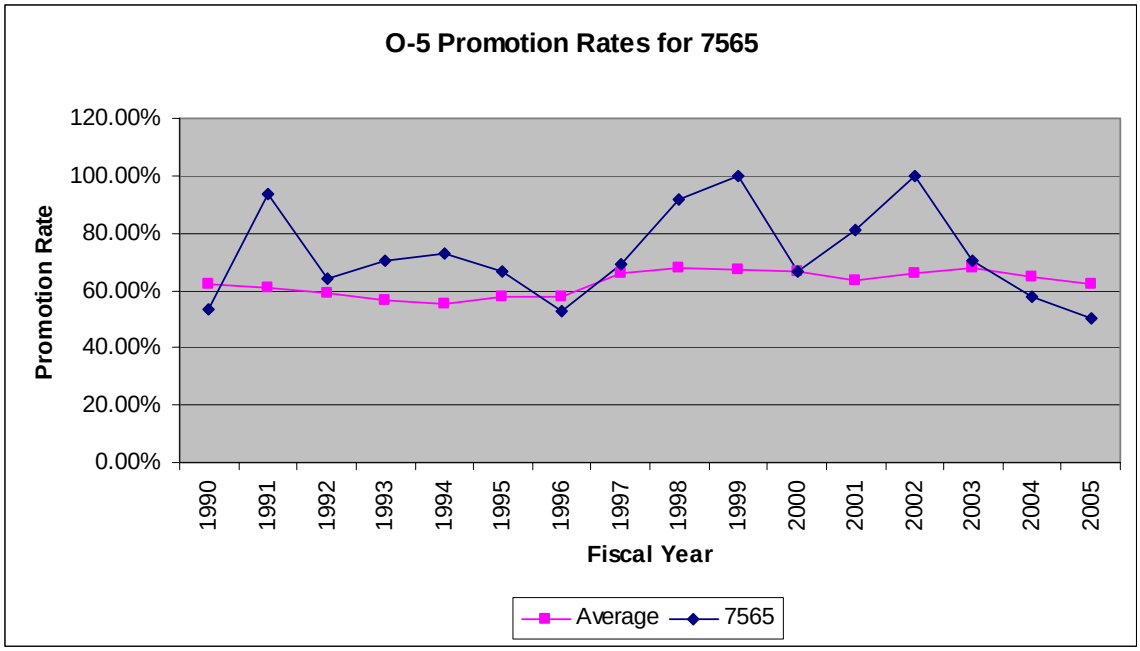

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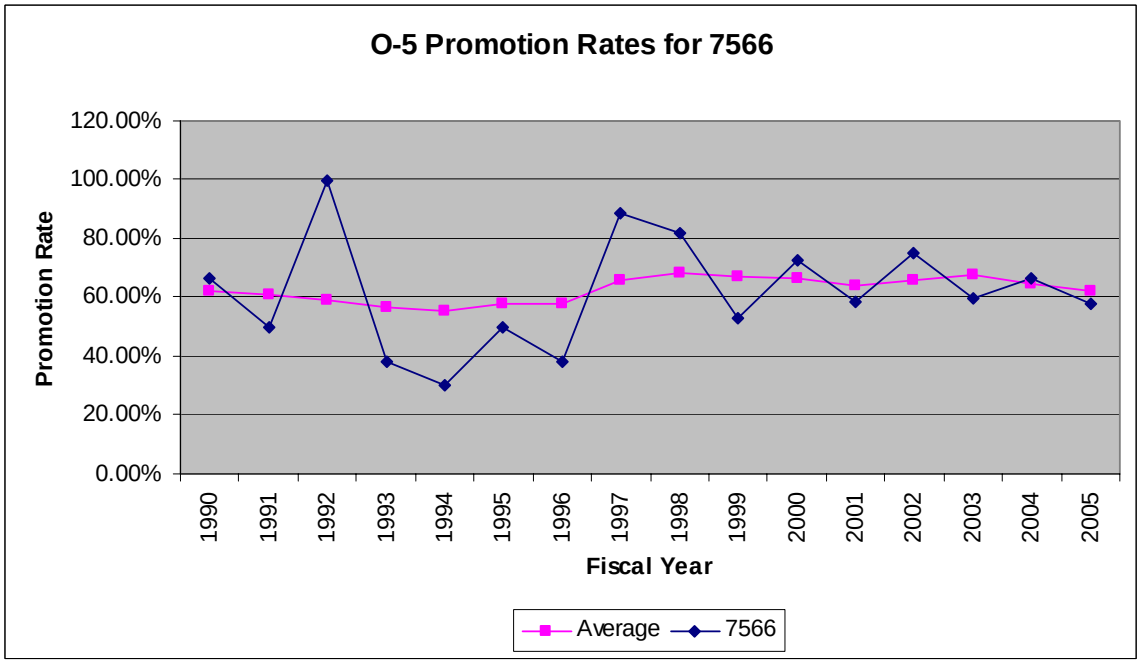

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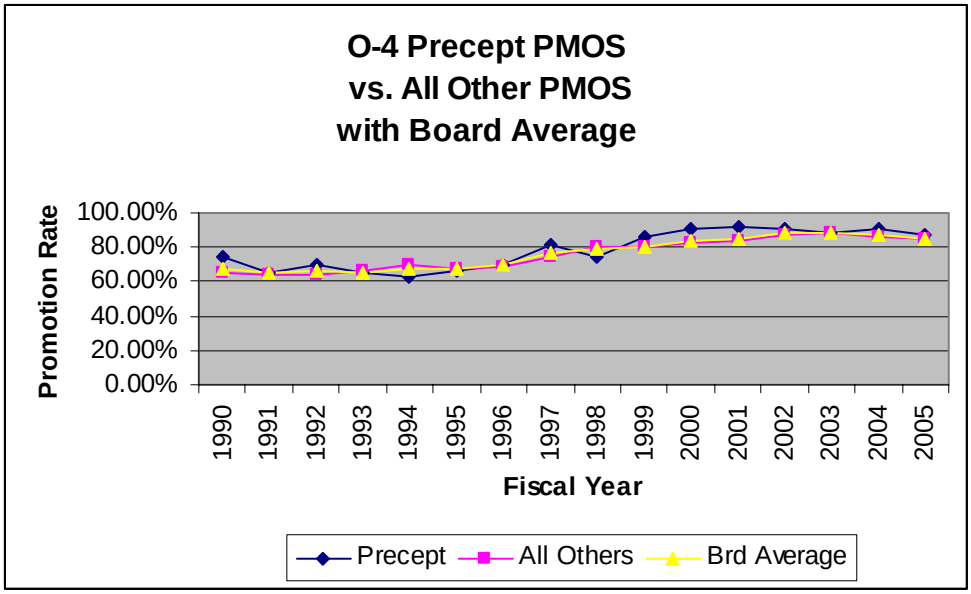
APPENDIX E. CRITICALLY SHORT PMOS PROMOTION COMPARIONS

A. O-4 PROMOTION RATE COMPARISION FOR PRECEPT PMOS, ALL OTHERS AND BOARD AVERAGE



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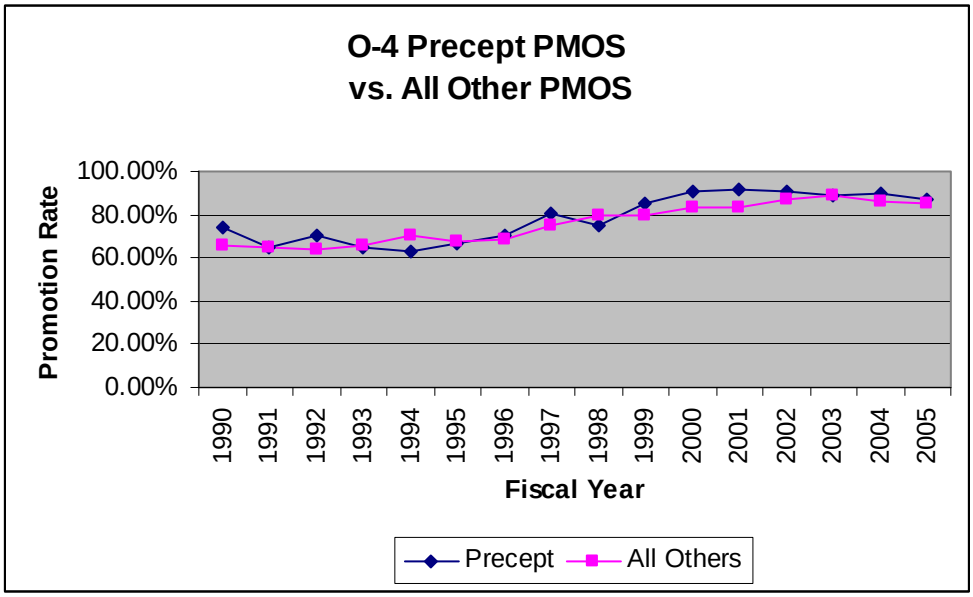

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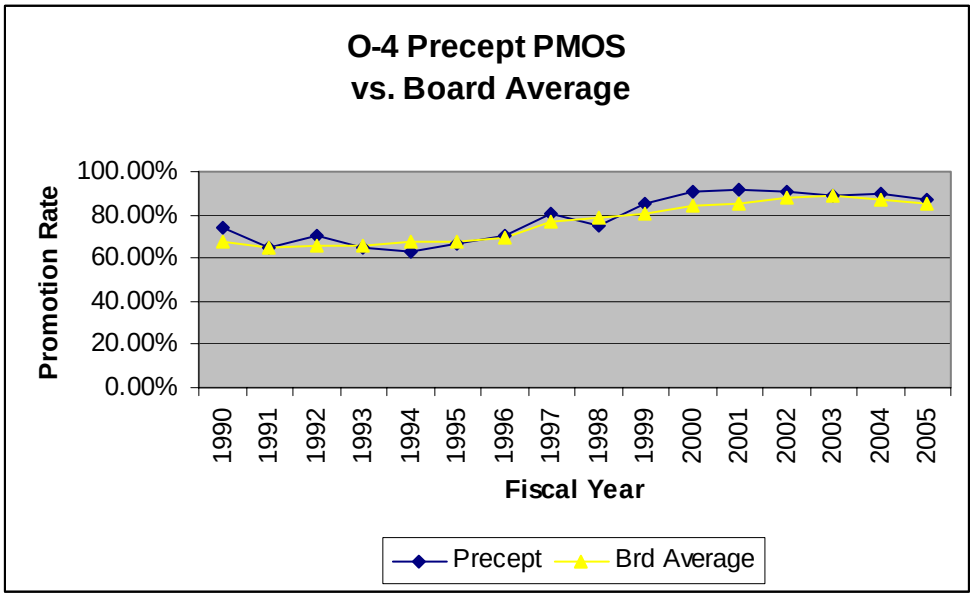

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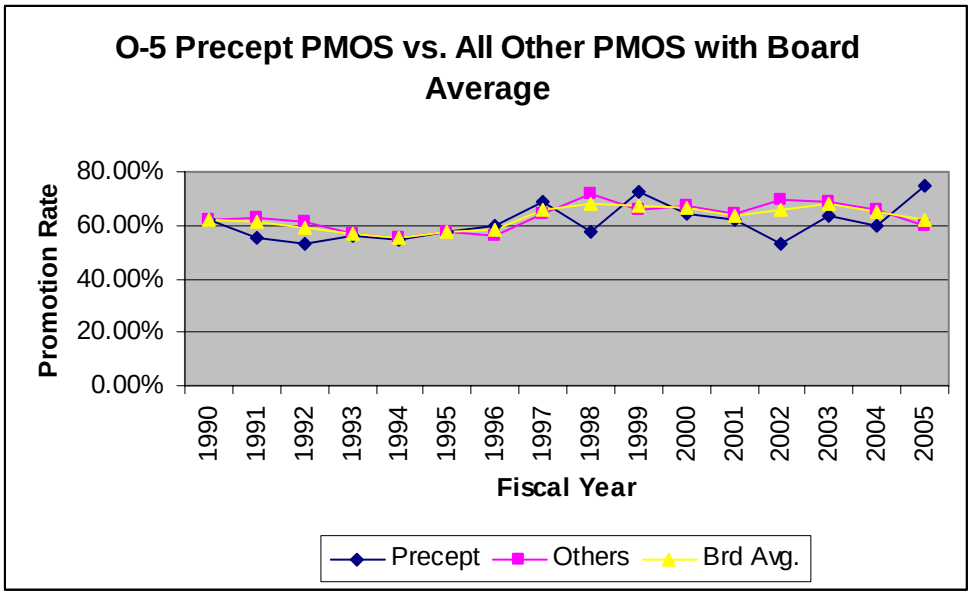

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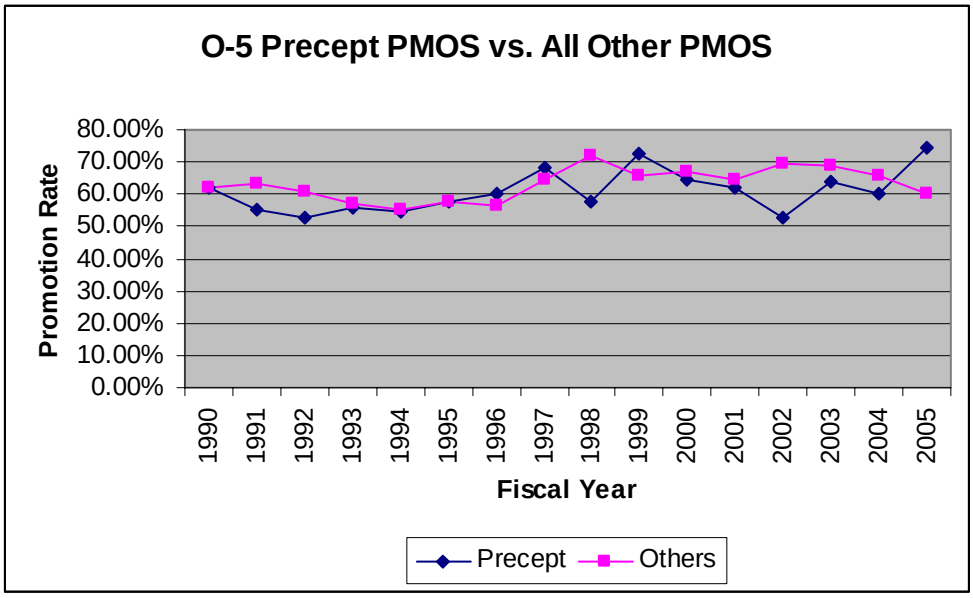

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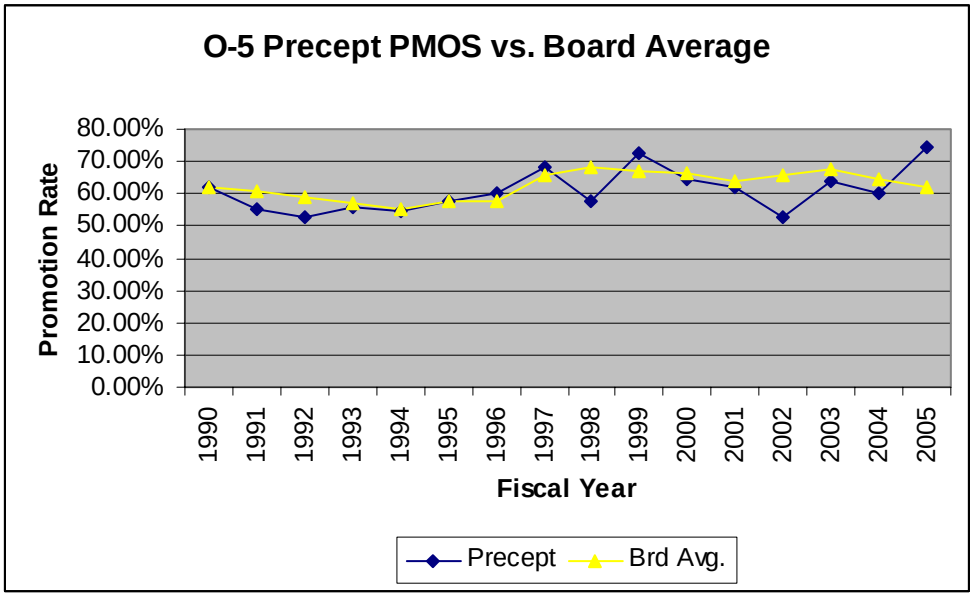

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